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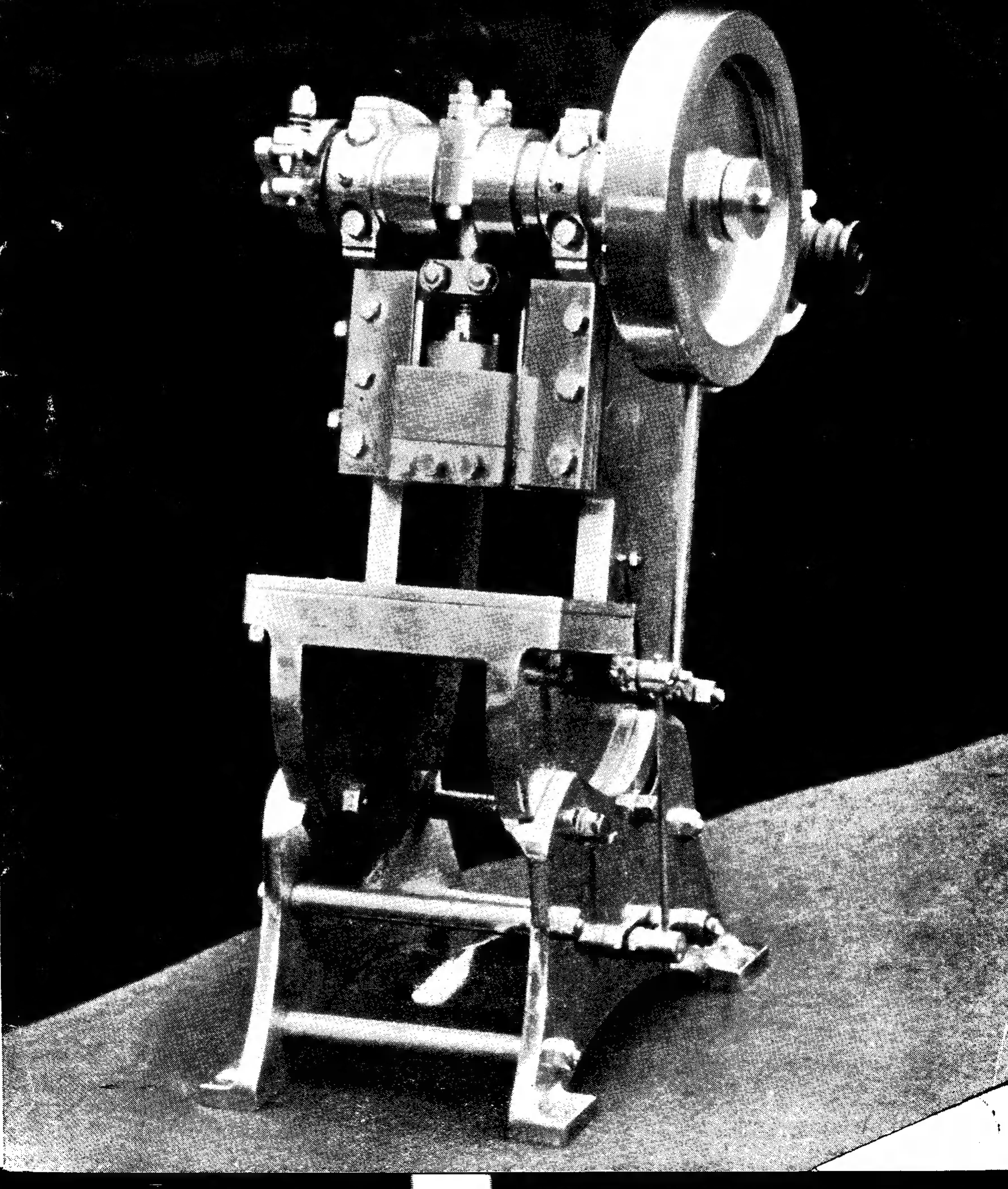
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

20TH DECEMBER 1951 VOL. 105 NO. 2639

SMOKE RINGS

Our Cover Picture

● THERE ARE many model engineers who are constantly looking for something a little out of the ordinary on which to exercise their skill in miniature reproduction. One such is Mr. Ezra Hoyle, of Bradford, if we may judge by the model seen in this week's cover picture. It is a 10 in. high replica of a power press of the type used for stamping out the details for such things as gas-masks. The model is exactly to scale and operates in precisely the same way as its prototype. It is equipped with the proper tilting movement to enable the scrap to fall to the back while the items stamped, blanked or formed pass through the central hole into an appropriate container or receptacle.

All the screws and nuts, including the $\frac{1}{16}$-in. "umbraco" screws, as well as the special $\frac{1}{16}$-in. tap for them, were made by Mr. Hoyle.

As Others See Us

● AMONG SEVERAL letters which we have received as a result of our recent reference to a Yorkshireman who made a miniature gold bicycle out of 292 parts, there was one which we think is worth quoting ; the writer says : "I cannot think of a more futile way of wasting time . . . It must have been an extremely tedious job and completely useless when finished.

"The trouble with you model engineers is that you take yourselves too seriously. If a grown man is so mentally undeveloped that he has to occupy himself with toy engines and boats, surely he should try and keep it dark, not boast about it and hold exhibitions of his 'work.' I am not suggesting that model engineers should be stopped from playing with their toys ; they do no harm, I suppose, but they should not offer us their opinions on matters which are miles above their limited comprehension. When one, who is presumably one of these simple souls himself, has the nerve to refer to serious designers and inventors as 'cranks,' it really is too much."

After reading thus far, we formed the conclusion that the writer of the letter was himself one of those "serious designers and inventors," and therefore he had every right to feel a little peeved at being regarded as a "crank." It is always as well to have the other side of the picture brought into view occasionally in any discussion, even if it is but a destructive criticism.

But our opinion, in the present case, was, let us say, considerably modified when, reading on, we came to the final sentence. After stating that he felt very strongly on the matter and could write more fully about it, but had not got the time, he finished by saying : "I am very busy, at the moment, engraving the entire works of Mrs. Beeton on a haricot bean."

Phew ! This makes us feel that reading THE MODEL ENGINEER is a "more futile way of wasting time" !

The Shortage of Transfers

● WE FREQUENTLY receive enquiries as to where it is possible to obtain miniature transfers of various railway emblems, coats-of-arms and the like, for use as decorations for small steam locomotives and coaches. Frankly, we do not know; so we have been making enquiries among possible suppliers, only to find that none of the manufacturers, apparently, will undertake to make such things. It seems that the high cost of production and the very limited demand do not make it worth while.

We find this difficult to believe. The model railway enthusiast, so far as "OO" and "O" gauges are concerned, is fairly well catered for in this respect—probably due to suppliers having laid in good stocks in the years before the war, when there was quite a demand for small transfers of railway initials, numbers, coats-of-arms and so on. But we recall that the man who wanted similar items for the larger gauges was very sparsely catered for; today, there is, apparently, nothing of the sort available to him.

Admittedly, the demand would not seem, at first sight, to be a very big one; but we are of the opinion that if some enterprising manufacturer of transfers would produce miniature reproductions of railway transfers used in the grouping period, as well as by some of the more important pregrouping railways, in 10-mm. ½-in., ¾-in. and 1-in. scales, he would have little cause to regret it. We believe that such a step would be more than likely to create its own demand. If the production of small die-castings, not only for model railway details, but also for small i.c. engines, c.i. engines, ships' fittings and other items, is still worth while, in spite of existing difficulties and restrictions, we are quite at a loss to understand why it should not be so in the case of small transfers.

Opinion and Counter-opinion

● IT WAS W. S. Gilbert who wrote something about a policeman's life not being a happy one; we occasionally wonder what he might have written about an editor's life! The first consideration for an editor is that he must set himself the target of pleasing all his readers all the time; and if there is anything in this life that is near to being a perfect impossibility, that is it!

So far as we are concerned, we are, of course, always striving to hit that target; the amount of success we achieve is to be judged, first, by the circulation of THE MODEL ENGINEER and, secondly, by the opinions expressed in many of hundreds of letters which readers write to us on such matters. So far as the circulation is concerned, a recent check on the figures discloses the fact that, during the past few years, weekly sales have approximately quadrupled. Need we say more?

Readers' opinions are always most carefully studied and analysed; their interest centres around their variety, which is a very wide one. On the one hand, we receive letters which tell us something like the following quotation:

"During the three years I have read THE MODEL ENGINEER, I have always read it from cover to cover as a matter of principle; you never know but what you may find some hint or tip which will prove helpful some time or other.

"... Another thing which I find so important is that THE MODEL ENGINEER is not just a magazine, but a mine of helpful information put in a friendly manner. I would rather have my 'M.E.' than any other text-book on engineering or its allied subjects. I have seen quite a few, too; and they all suffer from one thing: they tell you the how and the why of simple jobs, but the jobs which seem to call for a text-book are never explained. That is where our friend THE MODEL ENGINEER comes in; I learned more on the art of silver-soldering from 'L.B.S.C.' and experience than any book could tell me." That came from a Kentish reader who, in the same letter, was good enough to ascribe his successful professional career to what he had learnt from our pages.

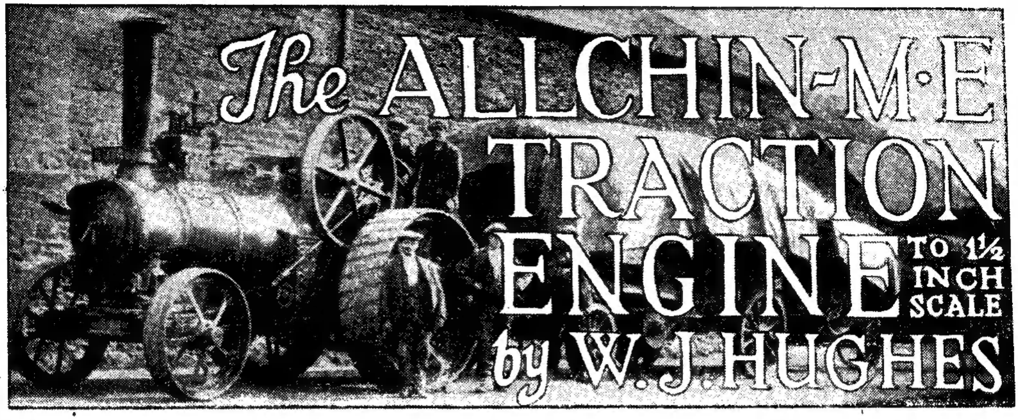
On the other hand, we occasionally receive letters of the opposite kind, and these, fortunately, are in such a minority that we are constrained to continue on the trail blazed by our founder and approved by the great majority of our readers. This does not mean that minority claims are disregarded; really constructive comments are always welcome, suggestions for new fields to be explored are carefully considered and other opinions canvassed. The contents of "Ours," as *you* receive it, is the result. In other words, and with an eye to present conditions, we publish the type of material which most generally represents or reflects the activities of the majority of our readers.

B.R. Oldest Locomotive Retires

● AFTER 82 YEARS' service, British Railways locomotive No. 58110 has gone to Derby Works for breaking up. This engine was the last survivor of the one-time numerous Kirtley 0-6-0 goods engines of the former Midland Railway, and was one of a fleet of 315 built at Derby between 1863 and 1874. No. 58110 was put to work as No. 778 in 1870; subsequently, she became No. 2630, later 22630 and, after nationalisation, 58110.

It was about 1878 that Mr. S. W. Johnson began to rebuild these engines; he fitted a boiler of his own design, and put a somewhat scanty cab over the footplate. Mr. R. M. Deeley succeeded Mr. Johnson in 1903, and then, in 1909, Sir Henry Fowler assumed control at Derby. Both these gentlemen left their "marks" upon the Kirtley goods engines, Deeley by modifying the smokebox and chimney, and Fowler by rebuilding many of the engines with a boiler having a Belpaire firebox and, in some cases, providing a larger cab.

No. 58110 bore evidence of the practice of all three of the famous C.M.E.s just mentioned, but, remarkable to relate, to a surprisingly slight extent. As withdrawn from service in November, she carried a Johnson boiler fitted with a Deeley smokebox; her cab was Johnson's; but she had lost her Deeley chimney which, some years ago, was replaced by one of Sir William Stanier's design. Apart from this, her appearance was the same as that which has been so familiar to older locomotive enthusiasts since about 1905.



The ALLCHIN-M·E TRACTION ENGINE TO 1½ INCH SCALE

by W. J. HUGHES

WHEN starting to describe the construction of a new model, it may seem rather queer to start at the "back end," but that is what I propose to do in this case. There are good reasons for this, into which it is not necessary to enter, but I do assure readers that it is not a mere whim on my part. So the first part of our traction-engine to be described will be the tender—but initially I want to recapitulate briefly the general construction of the prototype. (Photo No. 1.)

The boiler and firebox form the framework or chassis of the machine, with the engine mounted on top and driving the hind wheels through spur-gearing. The sides of the firebox are extended upwards and backwards to carry the bearings in which the crankshaft, the two countershafts, and the hind axle revolve; these extended sides are called the hornplates, and the tender is bolted to their rearward extensions.

At the front end the axle is carried in a fork affixed to a turntable, which rotates for steering on the "perch-bracket" riveted to the underside of the smokebox.

The lower half of the tender is occupied by a water-tank, the top of which forms the driver's footplate. Behind the driver the tender is partitioned off to carry the coal supply. In the case of the Allchin the driver's entrance is on the left, with two chequered footsteps leading to it.

By the by, please don't talk about the "cab" of a traction-engine. Tender or footplate, yes, but *cab*, emphatically no. Just a thought in passing!

Turning to Photo No. 2, we see some of the tender fittings. First of all, the fairlead or bollard through which the winding rope is led when the winding-drum is in use; it consists of two rollers mounted between two lengths of angle-iron which are bolted to the tender.

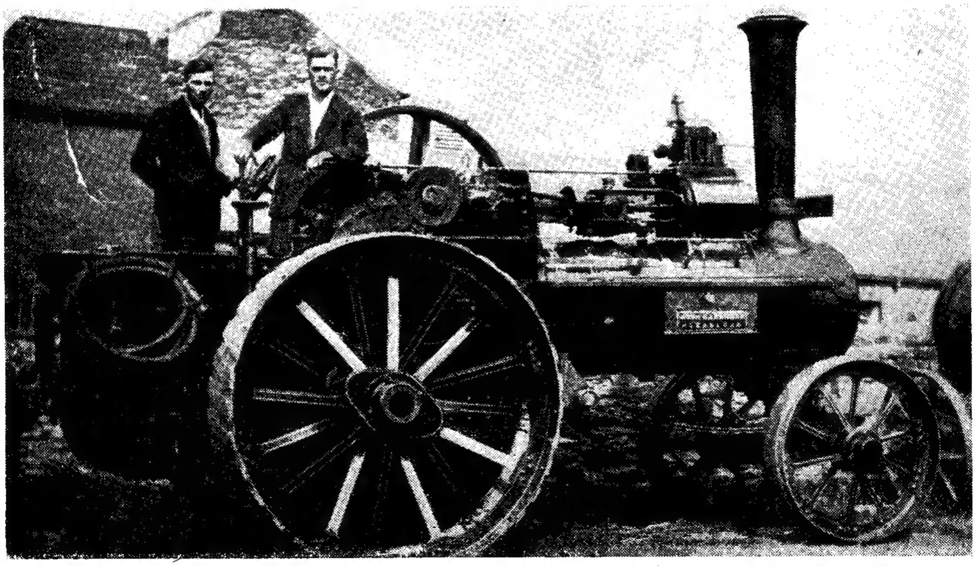
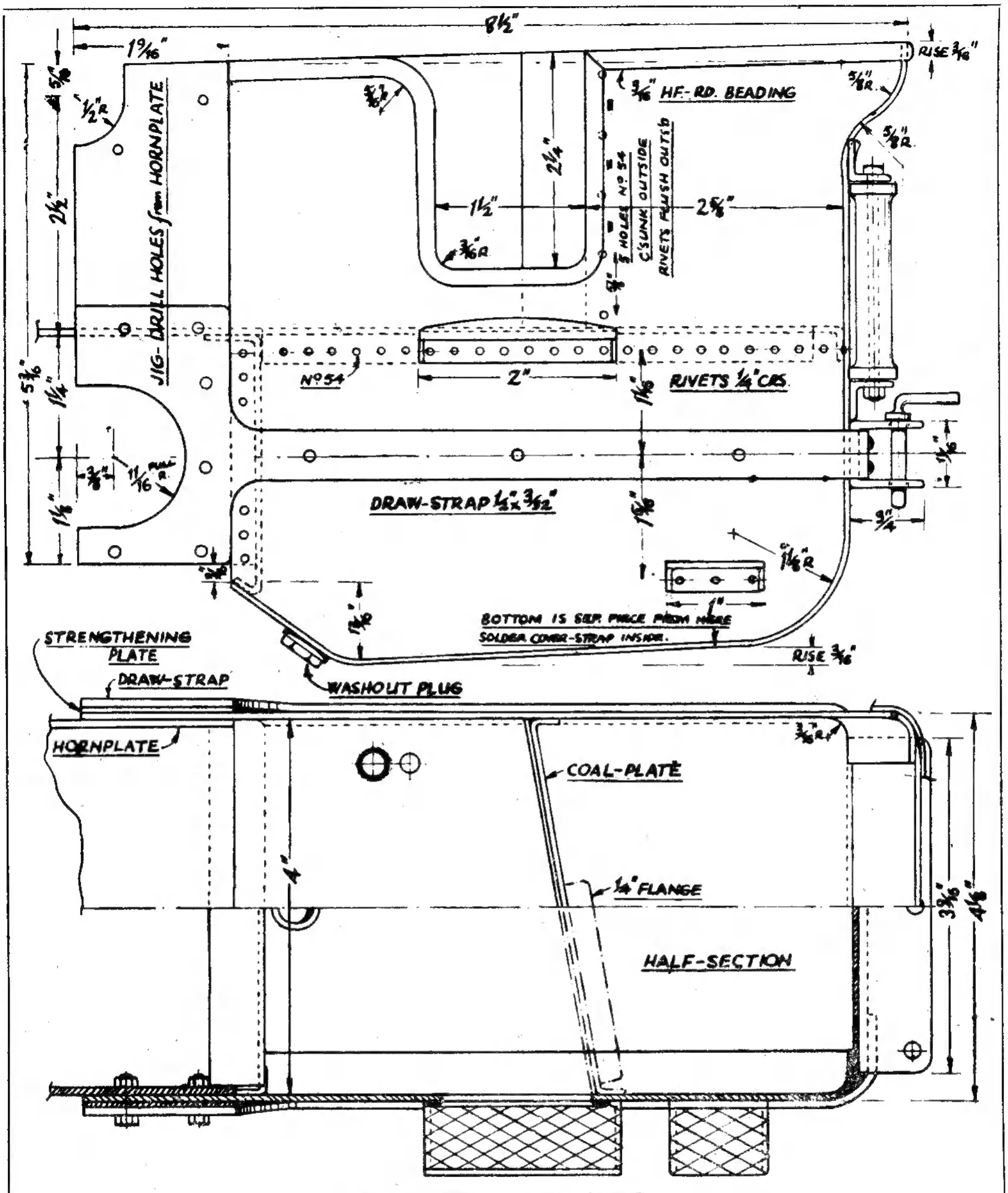


Photo by courtesy] [*J. G. Earnshaw*

Photo No. 1. The prototype when new in 1925—"Royal Chester," No. 3251, the last Allchin traction engine ever built



General arrangement of tender

Next is the drawbar, of channel section, which is riveted to the back of the tender. In addition, it is secured by two stout draw-straps the ends of which are bent round and riveted over the ends of the drawbar. These straps run forward, being secured to the tender sides by rivets, and at their front ends are forge-welded to large-ish plates. These are cut away to clear the spigots of the hind-axle bearings, which project through the hornplates from inside.

Looking at the general arrangement drawing, in plan, you will see that the draw-straps have to be joggled outwards near the front, to clear the strengthening plates on either side of the tender. These plates are on the outside of the tender sides, sandwiching the latter to the hornplates. In other words, the tender side is the corned beef (not that that's always *too* tender !) between the slices of bread of the hornplate and the strengthening plate. And when the holding bolts are tightened, the tender sides are clamped as in a vice, so that there is no shearing strain on the bolts.

As just mentioned, the draw-straps are joggled outwards to pass outside the strengthening plates,

and here the clamping-bolts pass through draw-strap, strengthening plate, tender side, hornplate, and flange of hind-axle bearing, giving a five-decker sandwich! But this does ensure that the strain of towing a load is taken direct from the hind axle to the drawbar, without being transmitted by the tender.

Reverting to Photo No. 2, we see that the water-filling hose is carried on two brackets bolted to the tender side; it encircles the water-lifter and the filling pocket. The former is a simple injector mounted on an elbow which passes into the tank, and connected to a steam-turret on the boiler. When the hose is coupled up to it, with its other end dropped in a pond or stream, and steam is turned on, water is "sucked up" the pipe into the tank. Or more correctly, a vacuum is created in the water-lifter, and atmospheric pressure forces the water up the pipe.

The filling-pocket has a hinged lid, and is used when filling the tank from a more conventional source by buckets or hose.

Also on the right-hand side of the tank is a manhole used when cleaning out or repairing the tank. The small tap or cock in the manhole is for testing the water-level, and a second one is mounted just above the draw-strap—just discernible on Photo No. 1, but hidden by the hose on Photo No. 2.

The injector which feeds the boiler is fixed to an elbow just in front of the manhole; it is almost hidden by the hind wheel in Photo No. 2. And here let me say at once that I shall specify one of "L.B.S.C.'s" injectors for the Allchin, with due acknowledgment to the maestro, for I have neither the inclination nor the patience to experiment with "jiggers."

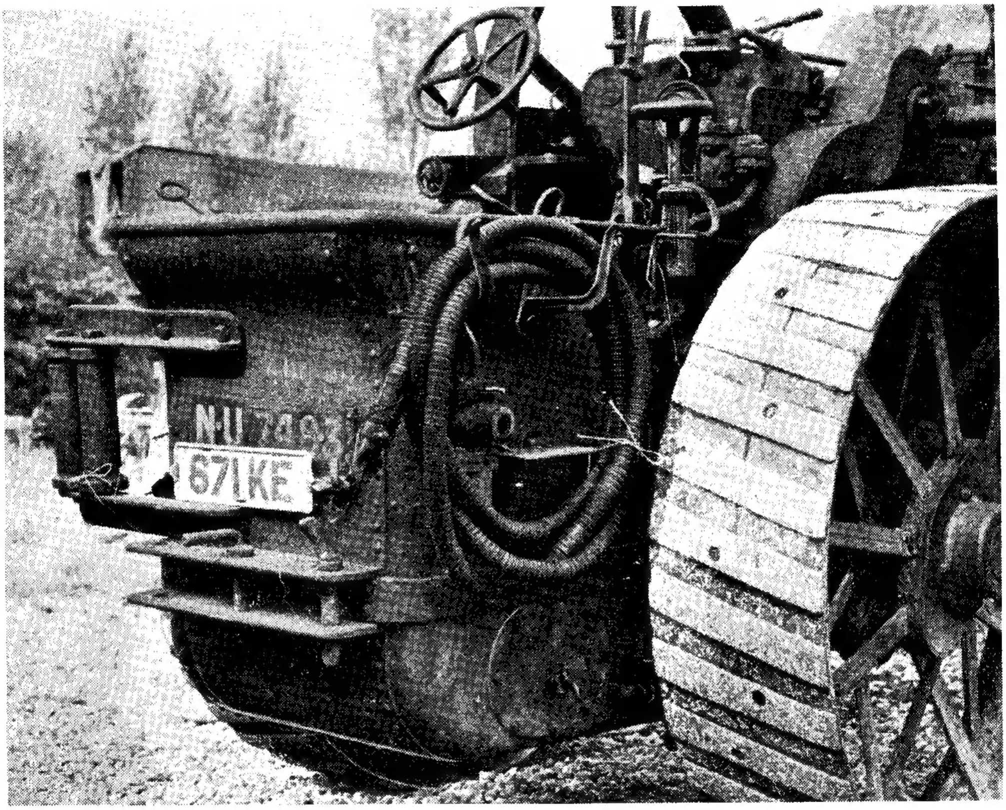


Photo by] [*Press Photo Agency*

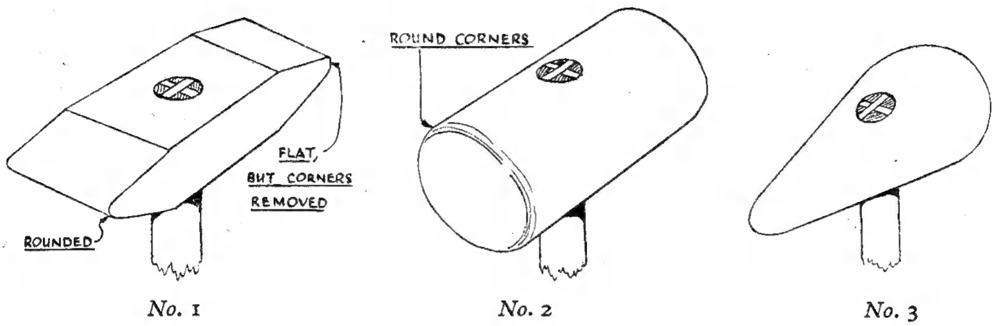
Photo No. 2. The full-size tender and hind wheel

Also fixed to the tender side are the brake bracket and the reversing-lever, but these will be described in their appropriate places and not at this stage.

The model tender is constructed throughout in 18-gauge brass sheet. If you bought one of the early blueprints you will find 16-gauge specified, but after experimenting I am finding 18-gauge amply strong, so have had the tracing altered appropriately. This gauge is not only easier to work, but has the merit that it is to scale. However, don't scrap your tender if you've already made it in 16-gauge!

The tender sides are flanged, and it will be necessary to make a former to assist in this

operation. A casting will be available for this former from A. J. Reeves, but I used a piece of teak, 1 in. thick, which had been in my "woodwork section" for years, just waiting for such a purpose. Any similar piece of hardwood about 9 in. × $6\frac{1}{2}$ in. would do. Set it out to the exact shape of the tender side elevation, but make it 3/32 in. *less* on the back and bottom edges, to allow for the thickness of the back and of the flange. It should be noted that the top and bottom edges are not at right-angles to the front, but each rise $\frac{3}{16}$ in. in their lengths.



Three types of mallet

Having set out carefully, the shaping should be done equally carefully; it is very necessary that the edges should be kept square with the faces, otherwise one tender side will be different from the other. If you aren't a woodworker, saw as close to the lines as you dare, and finish off with rasp and file, with frequent use of the try-square. In other words, think of the wood as a thick chunk of metal!

Having got the edges nicely square, the back and bottom edges on both sides need rounding off to a radius of $\frac{3}{16}$ in., which is the easy one at which the flanges are "taken round."

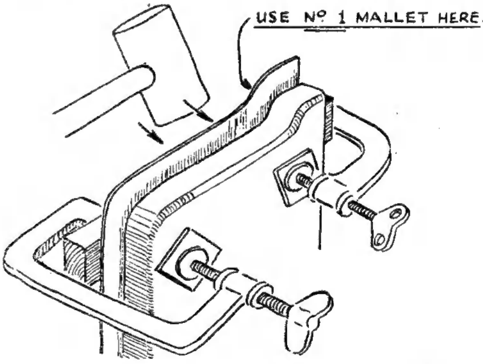
Flanging the Sides

Allow about $\frac{3}{4}$ in. extra on the back and bottom edges of the brass, to form the flanges, and file the front and top edges straight and at the correct angle to one another. Don't cut out the driver's entrance until the plates are flanged, and the same applies to the cutaway bits at the front, which eventually fit round the spigots of the third shaft and hind-axle bearings.

For flanging on a job like this, mallets are best—hammers are all right on boiler flanges, where the marks can't be seen, but *not* here. So if you haven't any, I'd advise you to make at least two, although you can buy them, of course, if so inclined.

Any good hardwood will do for the heads, but beech or boxwood is best. A friend of mine made three or four out of an old jackplane bought for a few coppers. The first one sketched is about $4\frac{1}{2}$ in. long and $1\frac{1}{2}$ in. × $2\frac{1}{2}$ in. in section, one end being tapered and rounded off to about $\frac{5}{16}$ in. radius, and the other end tapered and left flat about $\frac{1}{2}$ in. wide. The second is about 5 in. long by $2\frac{1}{2}$ in. diameter, and the egg-shaped one about the same or slightly smaller. This last is not needed on the flanging job, but is a useful one to possess. Each can be mounted on a hammer handle, or on a length of $\frac{7}{8}$ in. or 1 in. dia. dowel rod with its end saw-cut and wedged.

Now for the job itself, which isn't half as difficult as some chaps would have you believe. Clamp the brass and the former in the vice, with a piece of hardwood outside the brass to sandwich it. Take great care that every time you put them in the vice, the top and front edges of the sheet and the former coincide with each other. And if your sandwiching piece of wood isn't big enough, use a wooden strip clamped in position about 1 in. from the edge of the sheet. A pair of carpenter's G-cramps comes in useful here. If the sheet isn't clamped fairly close to the edge of the former, it will bend in the wrong places when you start to use the mallets, of course.



Starting to flange

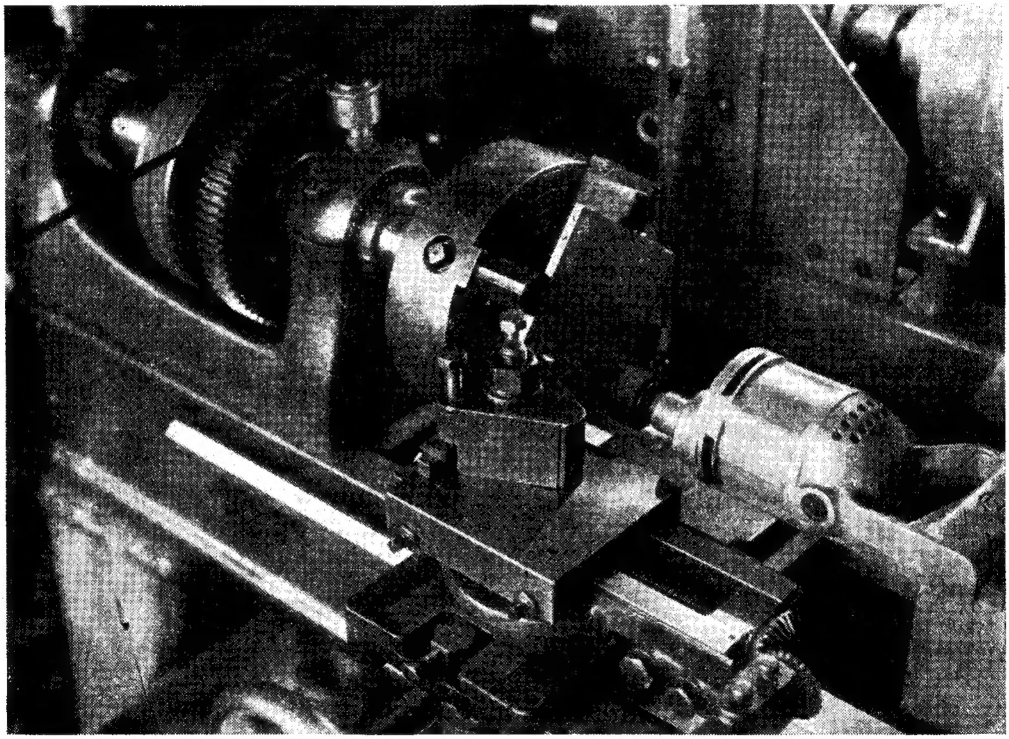
The "persuading" now begins, and I *mean* persuading—don't rush at the job like a bull at a gate! Use the mallet at an angle as sketched, and with a sideways motion, moving it steadily along with each blow. It is important to keep the angle of the flanging regular *all the way round*, and not to bend the metal more in one place than in another; and you'll have to move your clamping strip as necessary to secure that part of the edge being worked on at the moment. Mallet No. 2 will be used chiefly, but No. 1 will be used on that part where the inside radius occurs on the back edge.

(To be continued)

PROFILE CUTTING IN THE LATHE

by F. Butler

FOR one-off jobs, the usual way of cutting large holes in sheet material is to drill a series of small diameter holes, almost touching, and then to chip out the metal between them, ultimately finishing to size by the use of a file. The work is slow and tedious, and even for a single work-piece it is worth while trying to reduce the amount of manual effort. Where the model engineer is concerned, this usually implies doing the operation in the lathe. Matters are fairly simple if the work can be swung over the bed or saddle of the machine, and if the hole to be cut is bounded at its edges by straight lines or by circular arcs. The time-honoured way of cutting a large circular hole in a piece of sheet metal is to clamp it in position on the lathe face-plate, backed by some sort of packing, and then to cut a narrow groove at the desired radius, using a thin parting tool. As a rule, all goes well until the tool is just breaking through, after which it hooks under the uncut material and either breaks the tip of the tool or crumples the work into a shapeless mass. With rigid tools and the correct top rake it is possible to get good results except with very thin material. Even so, it is only possible to produce circular holes in relatively thin material.



Set-up for profile cutting in the lathe. The cutter is driven by an electric hand drill

Modern practice is to produce such things as templates by means of a profile milling operation, and the following notes show how the lathe may be adapted to do simple work of this type. If a toolpost milling attachment is available, the routine is well known and needs no description. In the absence of this accessory, an electric hand drill may be pressed into service, and will be found quick, accurate and simple to use on a wide variety of work.

To illustrate the principle of operation, suppose that it is required to cut a 2-in. hole in an aluminium plate 4 in. sq. by $\frac{3}{16}$ in. thick. It is first necessary to mount the job in a four-jaw chuck so that the centre of the plate runs truly. If now the electric drill is clamped firmly in the lathe toolpost, with a small end-mill held in the

chuck, it is theoretically possible to set the cross-slide at such a position that when the lathe spindle is rotated and when the end-mill is fed into the work by means of the saddle or topslide, a circular cut will be made in the work. If the axis of the end-mill is at lathe centre-height, a radial cut may be made by using the cross-slide. Off-set cuts can be made by packing up so that the milling cutter is above or below the lathe centre height.

In practice, this simple scheme will not work because the whole arrangement is lacking in rigidity, and it is necessary to support the milling cutter at a point which is very close to the work. This can be done by clamping a piece of square mild-steel or tool-steel bar in the lathe topslide, the end of the bar having a cross-drilled hole to suit the milling cutter. This hole forms a bearing for the cutter and it becomes unnecessary to provide any special support for the electric drill which drives it.

The best type of milling cutter to use depends on the nature of the material to be cut and on the accuracy of finish that is required. Suitable cutters are easily made up from short lengths of silver-steel. Experience shows that when cutting wood, ebonite, tufnol or aluminium alloy it is possible to use an ordinary twist drill ground square across the end, although the finish is not so good as when a specially made cutter is employed.

The photograph shows the actual set-up for an elementary operation, which is that of cutting a 3-in. hole in a 5-in. sq. plate of duralumin, to be used as the lens mounting board in a half-plate reflex camera. The hole could not be cut with a parting tool without tightening the chuck jaws to such an extent as to deform the finished plate. In this particular case, the hole was cut undersize and finished by a boring tool, taking very light cuts. The lathe was run in back gear during the milling operation, the belt being pulled round by hand.

Special work may require indexing by means of a division plate, or lathe change wheel, if radial cutting is necessary. In an emergency, the system may be employed for cutting keyways or splines, but it is most useful as applied to light work such as pattern-making in wood or non-ferrous metals, cutting rings or washers, for slot-milling or for preparing simple templates.

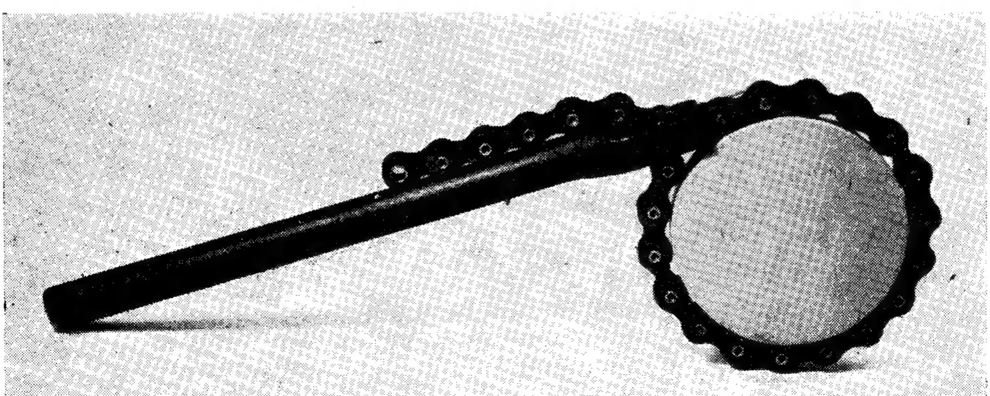
The advantages of the scheme are that all the requisite equipment is readily available in most workshops, very little preliminary setting-up is required, and a wide variety of work can be undertaken in the simplest possible way.

The "Gripital" Chain Wrench

MANY mechanics have undoubtedly been faced with the problem of turning a tight nut or screw cap for which no spanner or other special tool is available, and apart from the barbarous last-resort use of a pipe wrench or (still worse!) hammer and chisel, jobs of this nature can be a very real problem. A well-known device for dealing with this is by wrapping a strap or chain round the object and attaching a lever to the end. This principle has now been incorporated in a handy tool manufactured by Messrs. Melvin Ltd., 2A, Middle Lane, London, N.8, and marketed under the above name.

This is a simple and inexpensive tool, weighing $10\frac{1}{2}$ oz., incorporating a heat-treated carbon-steel lever and a length of cycle chain. In use, the chain is passed around the object, and its free end threaded through the rectangular slot in the lever. When pressure is applied in the appropriate direction, the chain is automatically locked, and the greater the leverage, the tighter is the grip. Owing to contact being made at a large number of points, the risk of distorting or marking the object is reduced.

It is claimed that the "Gripital" will do the following jobs: Turn a hexagon nut from 1 in. to $2\frac{3}{4}$ in. across flats; turn a valve with a wheel up to $3\frac{1}{2}$ in. dia.; take any irregular shape; remove a stubborn radiator cap without damaging the plating; unscrew a bicycle sprocket; or remove the screwed ring from a fruit preserving jar. This tool is obtainable from the makers, or alternatively, from Messrs. Richard Melhuish (London) Ltd., and many other tool shops.



The "Gripital" chain wrench in use, unscrewing a circular cap

Ending in a Flourish!

by L. C. Mason

A Mace for the Local Scout Group

MODEL engineers are well known for their occasional unorthodox approach to the awkward job; equally noteworthy is their adaption of ordinary methods to the unorthodox job.

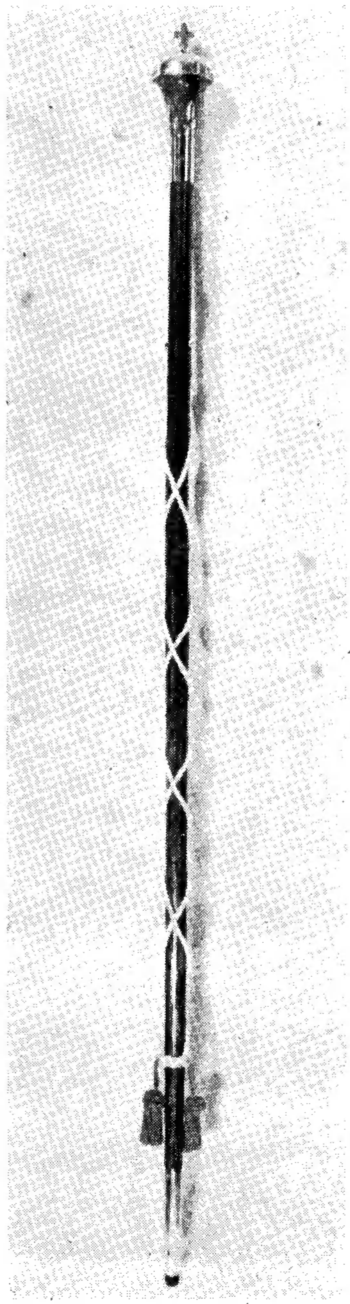
One of the latter sort, brought to a triumphant conclusion, is the mace shown in the photographs, made by Mr. E. G. Wilson, of Winchmore Hill, N.21.

Mr. Wilson has been actively associated with the Scouts' movement for some time, and was as concerned as his local group both over their lack of a mace for ceremonial occasions and the price asked for a professionally made one. After due thought, Mr. Wilsom offered to try his hand at making one. This offer, we gather, was received with polite detachment and some scepticism as to the possibility of such a project. This put the prospective builder on his mettle, and he set to work to "show 'em"—literally!

When he did show them, the reception accorded to the finished job was very different to that given to the original suggestion, and the mace has been used on numerous occasions with great pride.

The foundation is a piece of malacca cane, 4 ft. 9 in. long, for the stem. This is $1\frac{1}{4}$ in. diameter at the top end and was planed round freehand and sanded to give a very gentle taper down to $\frac{7}{8}$ in. at the foot. The head is of mahogany, and was turned from the solid. The stem, head, chromium-plated dome and top emblem are all separate, and so a method had to be devised to make a secure and permanent fixing. It would hardly do to have a highly decorated projectile launched at some important personage during a full-dress occasion!

The pieces forming the head are actually assembled



on a long draw-bolt, but before that stage the plated dome had to be produced. This was forthcoming very nearly ready made in the shape of the dome of a large bicycle bell, reposing in the junk box. This fixed the size of the top of the flared-out mahogany head on which it bears. The draw-bolt consists of a length of $\frac{5}{8}$ in. silver-steel rod, let well into the top end of the cane and cross-pinned by a $\frac{1}{8}$-in. silver-steel pin. The ferrule at the joint of the stem and head traps the pin so that it cannot work out.

At the top end of the $\frac{5}{8}$ in. rod a short length was turned down to $\frac{3}{16}$ in. and threaded 2 B.A. The dome was drilled centrally $\frac{3}{16}$ in., and the screwed rod passes through it, the $\frac{1}{2}$ in. thick ornamental base of the top emblem being tapped 2 B.A. to act as a retaining nut. The Scout emblem itself is also tapped at the bottom and serves as a lock-nut. To make doubly sure—Mr. Wilson is like that—the emblem-cum-lock-nut was cross-drilled and tapped for an 8 B.A. set-screw bearing on the 2 B.A. rod.

The figures and letters around the top, "18th EDMONTON GROUP," were cut out of $\frac{1}{16}$ in. sheet brass, the letters being $\frac{1}{2}$ in. and the figures $\frac{5}{8}$ in. high. The word "EDMONTON" was cut out of a single strip, and all characters are attached by 8 B.A. countersunk screws, nutted inside the dome.

At the foot end, solidity had to be the keynote, as some evolutions require the mace to be grounded every so often with a vigorous and guardsmanlike whack. For this reason the foot is furnished with a hardened steel tip. This is held in place by the long lower ferrule. A length of $\frac{7}{8}$ in. o.d. brass tube forms this, the lower end

Right—Close-up of top of mace, showing how the word "Edmonton" was cut from a single strip

being spun over slightly. The steel ferrule was then turned down to be a tightish fit in the tube, with the short length which protrudes turned down still further to pass the spun-over end. The steel tip was inserted in the top of the tube, the tube fitted to the shaped foot of the cane, and the tube then secured with round-head plated screws at its top end.

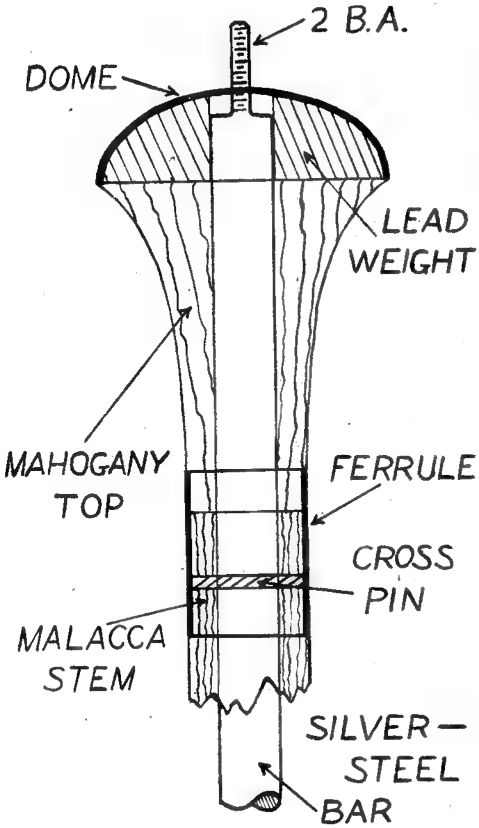
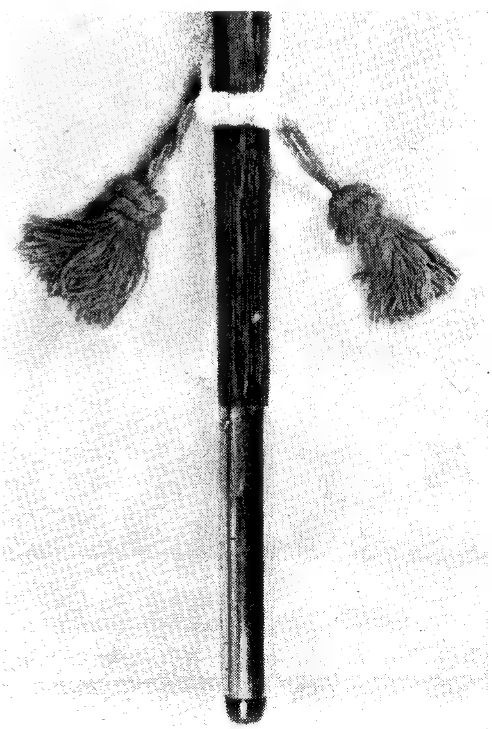


Diagram showing the construction of mace top. (Not to scale)

After a preliminary assembly came the all-important question of balance. The mace is handled almost entirely about a point a few inches below the head. As its overall length is 5 ft. 1 in., a sizeable counterweight is required in the head. During the construction, odd fragments of lead were collected and preparations made to cast them into a suitable weight. The mace was suspended on a string at the point



Right—Foot of mace, showing red tassels on white braid, and plated ferrule-retaining steel tip

of balance, kitchen weights attached by various Heath Robinson devices at the top end, and eventually a figure of 1 lb. 6 oz. was arrived at as being requisite.

The dome was thereupon dissembled, the characters removed, and a round fireclay core made up to provide clearance through the weight for the draw-bolt. The dome was carefully balanced, rim upwards, on a gas ring, the fireclay core placed in position and the lead gradually melted in the heated dome. When melted, the whole lot was allowed to cool—dome, complete with cored, shaped weight. The weight—still in the dome—was then marked through the letter-fixing holes round the edge of the dome, marked also for exact replacement, and then knocked out. At the marked spots round the weight shallow holes were drilled to clear the 8 B.A. nuts, and then channels cut from the holes up to the top edge of the weight to allow of it being replaced with the nuts in position. The figures and letters were then replaced round the dome and all the 8 B.A. nuts sweated over—again, just in case.

Head of mace, showing flared top, plated dome, and leaf decorations at the top joint

All the various metal parts were then sent for chromium-plating, and, on their return, finally assembled. Amongst the plated bits and pieces were two ferrules for the braid. These were turned from stubs of $\frac{1}{2}$-in. round brass rod and drilled through $\frac{1}{4}$ in. They are pressed into each end of a hole drilled across the upper end of the stem, and the white silk braid is passed through them to be laced round the stem to the bottom, where it finishes off in a sewn knot attaching the two red tassels.

Finish of the woodwork is french polish throughout on the natural colour of the wood, no staining having been done anywhere. The dark rich lustre of the wood, together with the sheen of the chrome, and the red and white flash of the braid makes a most effective whole.

The 18th Group are as proud of their mace as the maker is matter-of-fact about its building. But then, the real craftsman prefers to leave the admiration and talk about it to others—as Mr. Wilson has to me.

The Value of Craftsmanship

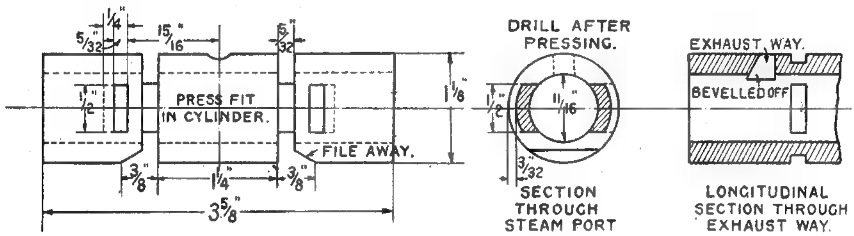
At the present day, industry is faced with one of the greatest crises in history, and in addition to shortages of materials and equipment, an even more serious scarcity is that of trained craftsmen. To quote a recent speech by the Rt. Hon. Sir Walter Monckton, Minister of Labour and National Service " . . . the need for well-organised training is greater today than it has ever been. We cannot increase appreciably, if at all, the *quantity* of labour at the disposal of our industries and services. We must, therefore, concentrate on improving its *quality*. Apart altogether from our immediate needs for quantity and higher productivity, I am convinced that the economic future of this country will depend on the extent to which we can maintain our high standard of craftsmanship, and the production of high quality goods for the world's markets." In the drive to promote craftsmanship, the amateur model engineer wields a greater influence than he knows. Model engineering forms an ideal training ground for mechanical craftsmanship of every kind, and even if its exponents have no desire to become professional engineers, they can do a great deal to advise and instruct others who may be so interested, and also to encourage appreciation of good craftsmanship. It is often said that craftsmanship is declining because it is not sufficiently well rewarded, in relation to the time and effort put into necessary training. While we fully agree that better incentives should be offered to good craftsmen, we would point out that many of the old craftsmen found their best rewards in the sense of achievement, and satisfaction in " something attempted, something done."

"Britannia" in $3\frac{1}{2}$-in. Gauge

Cylinder Details

by "L.B.S.C."

NEXT item will be cylinder covers, and these are a plain turning job needing little explanation. Chucking spigots or tenons will be provided on the front covers; chuck by the spigot, holding same in three-jaw, set to run as truly as possible, and face off. Turn the register to fit the bore of the cylinder, with a knife tool; and turn the outside edge to $1\frac{13}{16}$ in. diameter with a round-nose tool. The safest and truest way to hold the covers for machining the outside, is by using an improvised step-chuck held in three-jaw. The illustration explains itself. Chuck a short length of brass rod a little bigger than the cover—our advertisers may supply castings, as these step-chucks are very useful—centre and drill it about $1\frac{1}{2}$ in., or if you haven't a big drill, use the biggest available, and bore to size. Then turn a step on it about $1\frac{3}{4}$ in. diameter, and say $\frac{3}{8}$ in. deep. Reverse in chuck, gripping by the step; face off, and form a recess with a knife tool set crosswise in the rest, a full 3/32 in. deep and just large enough to admit the cover. Make a centre-dot opposite No. 1 jaw, on the outside of the piece; then cut one side completely through and make two short slits as shown. Replace the gadget in the three-jaw, with the centre-dot opposite No. 1 jaw again; put the cover in the recess, tighten the three-jaw, and Bob's your uncle. The spring of the step-chuck will enable it to grip the cover tightly without marking it, and it will run truly all ways. Turn away or part-off the chucking piece; face the cover, bringing the thickness to $\frac{1}{8}$ in., and there's another job done.



Liner for steam chest

The guide-bars on this engine are entirely separate from the back cylinder covers, as on the Southern "Schools" and "Nelsons," which makes the cover-machining easy, as they can be turned all over. Chuck in three-jaw by the gland boss, and proceed exactly the same as on the front covers, but make the register a fairly tight push fit in the cylinder bore. Centre, drill right through with No. 4 drill, and follow with a 7/32-in. reamer. Reverse in chuck, holding by the edge in the step-chuck mentioned above; face off the cover, turn the gland boss to $\frac{1}{2}$-in. diameter, and face it until it stands $\frac{1}{4}$ in. from the cover. Open out the hole to a bare 11/32 in. diameter, and 11/32 in. depth, and tap $\frac{3}{8}$ in. × 32. Now a word to the wise—unless the tapped part of the hole is absolutely concentric with the plain part, the piston rod is going to bind when the gland is in; so do your opening-out with a pin-drill. I've already explained how to make these, in the notes about *Tich*, and the small amount of time spent in making one, well repays by ensuring that all holes enlarged with it, are perfectly concentric. I have a small drawer full of home-made pin-drills, and they come in mighty handy. Also when tapping, use the tailstock chuck to guide the tap; another oft-explained wheeze.

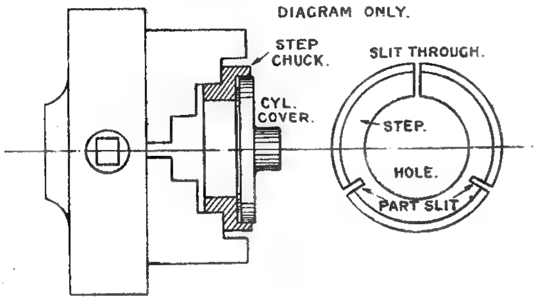
The glands are turned from $\frac{1}{2}$-in. round bronze rod held in three-jaw. Face, centre, drill down $\frac{1}{2}$ in. depth with No. 4 drill; turn down a full $\frac{1}{4}$ in. of the outside to $\frac{3}{8}$ in. diameter and screw $\frac{3}{8}$ in. × 32 with a die in the tailstock holder. The gland should fit the stuffing-box without any shake; if it is slack, it will work out when the engine is running. Part off $\frac{1}{8}$ in. from the shoulder; rechuck in a tapped bush held in three-jaw, skim the face off truly, and poke a 7/32 in. reamer through. The flange is slotted for C-spanner operation, either by milling, planing or shaping, or by simply filing with a thin flat file as used by clockmakers. Screw the gland into the stuffing-box, and poke the 7/32-in. reamer through the lot by hand, driving it with a tap-wrench on the shank.

Drill 12 No. 34 holes around each cover, at a full $\frac{1}{8}$ in. from the edge, so that the screws will be midway between the bore and the edge of the flange. Ten of the holes are equally spaced, but watch your step on the two which will come on either side of the end of the passage between steamchest and bore; these may be spaced a little wider apart, to miss the opening. Use each cover as a jig or guide to mark the location of the screw-holes in the flanges, drill the flanges No. 44 at the countersink marks, and tap 6 B.A. Note:

don't drill by hand; if you have no drilling machine, use the lathe, holding the cylinder with one end against a drilling pad on the tailstock barrel.

Pistons and rods

Ever since the early days of the Live Steam notes, I've been using ground rustless steel for piston-rods and valve-spindles (*Ayesha* has them) so I can recommend the use of that material; but hard-drawn bronze, either phosphor or nickel, makes a good second choice. Two pieces 7/32 in. diameter and a full $3\frac{5}{8}$ in. long, will be required; chuck in three-jaw and put $\frac{1}{4}$ in. of 7/32 in. $\times$ 40 thread on one end of each, using a die in the tailstock holder, as the threads must be absolutely true.



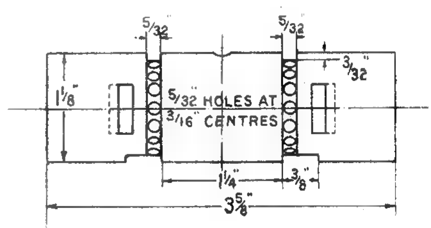
How to hold covers for finishing

The pistons can be made from drawn bronze, rustless steel, or automobile piston metal. If you can get hold of a scrap alloy motor piston, it can be melted down by aid of a five-pint blowlamp and a fair-sized plumbers' ladle, and recast into a stick about $1\frac{3}{8}$ in. diameter, using a bit of cardboard tube for a mould, or some similar improvisation. Whatever else you do, see that the mould isn't damp; if it is, you risk a bang, and stopping flying beads of molten metal with vulnerable portions of your anatomy. Our approved advertisers may be able to supply cast pistons of this material, or perhaps monel metal. Anyway, whatever you are using, chuck in three-jaw and turn down about 1 in. length to about 1 5/32 in. diameter. Face the end, and drill $\frac{3}{16}$ in. for $\frac{1}{2}$ in. depth. Rough-turn the groove $\frac{1}{4}$ in. wide and $\frac{1}{4}$ in. full depth, and part off a full $\frac{7}{16}$ in. from the end. Ditto repeato the drilling and grooving, part off second piston, and then rechuck one of them in the three-jaw. Open out the centre hole for half its depth, with No. 3 or 7/32 in. drill, and tap the remains 7/32 in. $\times$ 40. Put a piston-rod in the tailstock chuck, screwed end outwards; run the tailstock up to the piston, enter the rod in the hole, and pull the belt by hand until the rod is drawn right into the hole, and the screwed part is projecting about 1/32 in. from the other side of the piston. This "precision-lathe-chuck" method of fitting, is the best I know.

To finish off, chuck the piston-rod either in a collet chuck, or a split bush held in the three-jaw. The latter wheeze was described in the *Tich* notes. I would earnestly recommend all locomotive builders who have the usual type of home-workshop lathe, to fit a few collet chucks to the mandrel, for jobs like the above. Simply turn a short bit of mild steel, as long as the lathe centre, to a taper that will fit the mandrel nose. Face, centre and drill it, in position, to take the desired rod a sliding fit; No. 3 or 7/32 in. the present instance. Cross-slot it about three parts of its length with a thin hacksaw; tap the small end any convenient thread ($\frac{1}{4}$ in. $\times$ 26 or 40 in the present instance) and screw in a length of rod, long enough to reach to the back end of the mandrel, and project about $\frac{1}{2}$ in. Screw that end also, and fit a nut and washer; Whitworth thread should be used for quick operation. Put the taper in place in the mandrel nose, put the nut and washer on the back end, and tighten the nut until the taper just seats home; just that and no more. Put the drill down again, to clean out any burrs caused by hacksawing, and the collet is ready for use. Put the piston-rod in, so that the piston is right up against the collet; tighten up the nut on the end of the spindle. If you have drilled the hole accurately, the rod will be held firmly and true. Face off the projecting bit of piston-rod, flush with the piston; then very carefully turn the edge of the piston until it is an exact sliding fit in the cylinder bore. Piston and rod will then be true with each other; and if the gland is O.K. also, you'll get a piston that is steamtight, yet not mechanically tight. All the packing will have to do, is to act as a lubricating pad, keeping the cylinder bore oily whilst the ram of the mechanical lubricator is sucking up a fresh charge.

Steam Chest Liners

About the best way to turn a cast steamchest liner that has no extra length allowed for chucking—in these days of material shortage, you can't expect too much from our harassed suppliers!—is to chuck it in the three-jaw and bore it out to



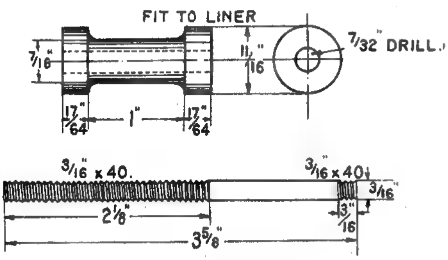
Alternative liner

say $\frac{5}{8}$ in. diameter, same way as you bored the cylinders. Face off the end. Now mount it on a mandrel between centres (Bro. "Iron-wire" Alexander, the old pioneer, would have raised a cheer at that) and turn the outside to a diameter that just *won't* go in the steamchest bore, says Pat. Now, once more, watch your step mighty carefully. Turn down about $\frac{1}{8}$ in. of the end until it just *will* enter, pretty tight. If your cross-slide screw has a "mike" collar, note the reading. If it hasn't, take particular note of the position of the handle or wheel; if the latter, you can mark

it, and put another mark opposite it, on the end of the slide. Turn the handle back half [redacted] turn, to counteract any slack in the screw and nut, then turn it forward again until within half-a-division of the previous collar reading, or if [redacted] collar, until the handle or wheel is almost, but not quite, at its previous position. With this setting, turn the rest of the liner, and it should then be [redacted] press fit in the hole in the cylinder. Face off the unturned end to correct length, viz., $3\frac{5}{8}$ in.

Get Scratching!

Chuck in three-jaw again, and bore to within a few thousandths of finished size, finishing with an $\frac{11}{16}$ in. parallel reamer, [redacted] described for cylinder boring. Make [redacted] mark (scratch will do) exactly in the middle of the length of the liner ; and at $\frac{5}{8}$ in. [redacted] either side of this, make another scratch, and yet another, 5/32 in. farther along. Between the scratches, cut a groove 3/32 in. deep with [redacted] parting tool. The top and bottom of these grooves have to be cut away to a depth of $\frac{5}{16}$ in. from the outside of the liner. With [redacted] milling machine, or a planer [redacted] shaper, this job is just a cakewalk. In my own case, I just hold the liner in the machine-vice [redacted] the miller table, the liner being set parallel



Valve and spindle

to the mandrel, and traverse it under a 5/32-in. saw-type cutter on the arbor, the job being done in the proverbial two wags of [redacted] dog's tail. It would take [redacted] little longer using a planing or shaping machine, as only a single-edge tool is used in the clapper-box, and the job done with a succession of cuts ; but the result is the same. The liner could be mounted at the correct height in a machine-vice (regular or improvised) on the lathe saddle, and traversed under [redacted] cutter on a spindle between centres ; [redacted] thinner cutter would do the trick, if two or more " bites " are taken. As [redacted] last resource, the metal could be carefully filed away from between the grooves. When done, these should be [redacted] 5/32 in. port, [redacted] little over $\frac{1}{4}$ in. long, showing at opposite sides of the liner bore, [redacted] shown in the part longitudinal section.

There is an alternative method, which is to drill [redacted] ring of 5/32-in. holes all around the liner at the bottom of each groove. It doesn't matter if the spacing is slightly uneven, as long [redacted] the holes don't cut into the sides of the grooves.

As the passage-ways from bore to steam chest [redacted] each end of the cylinder, naturally won't line up with the ports, file away [redacted] bit of the liner at the outside edge of each port, [redacted] shown, at what will be the bottom of the liner when it is pressed in. I've shown the gap [redacted] $\frac{1}{8}$ in. wide, [redacted] on my own cylinders, but it can be varied if you have got off the road a little when drilling your passageways.

Finally, mark off the exhaust ports—entrances to the way out—at the positions shown, at a slight angle to the bottom clearances (see cross-section in last instalment) and cut them either by end-milling, or by drilling holes and filing them into [redacted] slot. Note : to ensure that the steam will always have [redacted] free exit, bevel off the sides nearest the ends of the liner, [redacted] shown in the part section. This is easily done with [redacted] thin flat file [redacted] used by key cutters, put through the port and used on an angle. The exact size of the inside hole doesn't matter. The liners can then be squeezed home, inserting the reduced $\frac{1}{8}$ in. at the end, and finishing the squeeze by any convenient means ; I have [redacted] bush press that is hot stuff at the job, giving a more fervent squeeze than any lover ever seen on the films. If your bench vice will open its jaws wide enough, use that. A trick as old as the hills, is to put [redacted] long bolt through liner and cylinder, drawing the liner in with a nut on the bolt. This was illustrated in the notes on either *Doris* or *Pamela*, I forget which, at the moment. Make sure the liner goes in, so that the filed-away sections line up with the passageways, and the exhaust ways line up with the openings in the steamchest bore ; also the same amount, viz., $\frac{1}{8}$ in. should project [redacted] each end of the cylinder.

Keep Calm!

If you're unlucky, and turn the liners an easy fit, don't fret and lose any beauty sleep. Just tin over the outside of the liners, and the inside of the bores ; wet with Bakers' fluid or any other good soldering flux, put the liners in place, and heat the whole bag of tracks to the melting point of the solder. When it melts, it will make [redacted] perfect seal between liner and cylinder ; scrape off any superfluous solder showing at the ends, and if Inspector Meticulous complains, just emulate the lion on the British Railways' crest. I read in the daily paper that Prince Charlie did that to a press photographer who aimed his camera at him!

It is probable that the liners may be slightly distorted, or crushed [redacted] wee bit, after the pressing operation. Well, drill the steam hole, using the hole in the cylinder for [redacted] guide, then poke the $\frac{11}{16}$-in. reamer through by hand. This will true and " size " the bore, and remove any drilling burrs, at one fell swoop.

The covers at the ends of the liner are plain turning jobs, which can be carried out in the same way as the cylinder covers ; but the spigots should be [redacted] tight push fit in the liner bore. The front one is drilled 5/32 in. and tapped $\frac{3}{16}$ in. $\times$ 40, to take [redacted] oiling plug, which is turned from $\frac{3}{8}$-in. rod to represent [redacted] tail spindle cover ; see longitudinal section recently shown. The back cover is drilled No. 14 and reamed $\frac{3}{16}$ in. for the valve spindle ; no gland is required. As there is only exhaust pressure to contend with—and this is very little [redacted] my engines, [redacted] *Jeanie Deans* or *Grosvenor* would confirm—four 3/32-in. or 7-B.A. set-[redacted] at each end, put through the liner into the cover spigot, will be sufficient to prevent them coming out in service.

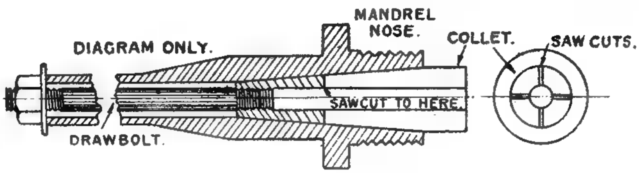
Valves and spindles

Contrary to the teaching of that well-known member of every club, who avers that piston-valves [redacted] good unless fitted so exactly that the warmth of your hand will expand them enough to make them stiff, the piston-valves should be a nice sliding fit. A piece of $\frac{11}{16}$ in. ground rustless steel should fit the reamed liner correctly. There should always be [redacted] very thin film of oil between the bobbins and the liner, and never [redacted] metal-to-metal contact, otherwise both bobbins and bore will be scored, and the valve will blow like old Harry. Chuck the rod in the three-jaw, face the end, centre, and drill down about 1⅝ in. depth with 7/32-in. drill. Starting at 17/64 in. from the end, turn 1 in. length to $\frac{7}{16}$ in. diameter; if you are doubtful of your accuracy, start 9/32 in. from the end, part off at 9/32 in. from the end of the reduced part, and chuck again in three-jaw, to face off the ends of the bobbins to exact length. Both ends should be exactly the same length when tested with a "mike" or calipers. Terribly difficult job making a piston-valve, isn't it? Any of my girls in the Kaiser's war munition shop, would have made them by the gross, and thought nothing of it!

The valve-spindles are merely 3⅝ in. lengths of $\frac{3}{16}$-in. rustless steel or bronze rod, with 2⅛ in. of $\frac{3}{16}$ in. × 40 thread on one end, and $\frac{3}{16}$ in. of the [redacted] pitch on the other. All being well, in the next spasm we'll see about assembly and erection.

All the best!

As you'll be reading this [redacted] few days before Christmas, I'll close with [redacted] friendly greeting. It was my intention to include some more Christmas reminiscences; but the honest truth is, that it makes me sad to write them. Thoughts of the happy carefree days of childhood, life on the railway, and so on, will not bear comparison with present-day conditions. If people—and countries—concentrated [redacted] minding their [redacted] business instead of meddling in each others' affairs, [redacted] they did in those days, things might have been different; and [redacted] boy who entered the railway service, [redacted] young Curly did, with the idea of working his way up to driving the company's crack expresses, wouldn't have been yanked out of the locomotive sheds for [redacted] course of lessons in bloodshed and destruction. Such is the progress of so-called civilisation! However, this is no place for sermonising; please forgive the passing thoughts of an old fogey who belongs to [redacted] bygone generation. My wish to everybody who reads this, is just that you may have a good time during the Christmas holiday, with family, relations, friends, or sweethearts, [redacted] the [redacted] may be. It does folk a world of good to "have [redacted] break," so make the most of it. The dearest wish of old Curly's "Peter Pan" heart, is that one and all will get more out of 1952 in the way of happiness, prosperity, and pleasure, than ever they did from 1951, and good health to enjoy your blessings; so cheerio and the best of luck!



An improvised collet chuck

"O" Gauge Steam Locomotives

Mr. C. L. Bennett writes:—"Mr. W. F. Gentry's L.B. & S.C.R. class E5X 7-mm. scale tank engine certainly deserves the praise given to it in [redacted] recent "Smoke Ring." There is something definitely Brighton about it and I wonder if other readers have noticed what it is that makes it so. Well—most definitely the chimney. The best example I have seen in this scale of [redacted] Billinton chimney and, together with the smokebox, the camera has been able to do it full justice. In a photograph of [redacted] locomotive it is always the chimney I look at first.

"This is history repeating itself, for my miniature 7-mm. scale reproduction of [redacted] Stroudley 0-4-2 tank engine—but burning solid fuel (built just on 28 years ago)—had the honour of mention on the Editor's page, once being referred to [redacted] 'precocious.' Well, it has held the field for many, many years in its class!

Please do not imagine that I [redacted] blowing my whistle, but I feel that it set [redacted] standard, and naturally have always looked with a critical eye [redacted] 7-mm. scale steam miniatures."

Model Power Boat News

by "Meridian"

*The class "B" Record-holder—*Sparky II*

THE construction of this type of hull is not terribly formidable, although good workmanship is necessary so that it will be strong enough to stand up to the vibration of the engine, and also to survive any of the mishaps that all racing boats seem to have at some time or other.

The main material used in making the hull is 1 mm. plywood (resin bonded), together with ¼ in. sq. hardwood stringers, and some balsa for the sponsons and certain portions of the decking. There are few screws used in the construction; most joints are glued and pinned with thin panel pins.

An unusual feature is that no bearers or ribs proper are used, but strengthening-pieces of ¼ in. ply are glued on the 1 mm. ply; for example, these stiffeners are used as engine supports and the engine is secured by bolts through the sides of the hull. These bolts have large washers under the heads to protect the plywood from injury.

Here is an outline of the sequence of construction: the sides are cut out of the 1 mm. ply and trimmed up, being cramped together so that both are exactly the same. Referring to the side outline drawing of the hull, it should be noted the sides proper are only about half of the total height of the boat. The sides are indicated by the dotted lines which continue on either side of the engine cockpit. Note also that the last 3 in. of the rear floor is raised a little so that it is finally ⅛ in. above the reference line. (Reference line is taken as the flat floor of the hull which extends from the sponsons to the beginning of the rise mentioned.) After the sides are prepared, hardwood stringers are pinned and glued to both inside edges. The glue used was "Casco" waterproof glue, which has been very satisfactory, but some of the special resin glues recently described in THE MODEL ENGINEER might be even better for this purpose and may be worth trying.

The next stage is the transom and flat nose-piece. (The balsa nose extends about 1½ in. from this flat piece.) Hardwood of $\frac{5}{16}$ in. thickness is used for both of these, and then the sides can be fitted together, using a temporary piece of wood at the centre, in order to spread the hull to the correct plan outline.

Now the bottom is cut roughly to shape and can be fitted and trimmed off. The rear planing strip is formed by two wedge-shaped pieces of hardwood, about 5/32 in. thick and the floor of this is 26 gauge aluminium, attached with No. 0 countersunk screws. The plywood of the floor above this is, of course, cut away to allow the propeller shaft to pass through.

The sponsons are now cut to shape from balsa wood; the hard grade being used. The hardwood dowels are socketed into the balsa, and fixed with balsa cement. Where the doweling goes through the hull, the sides are stiffened up with $\frac{3}{16}$ in. ply. At this stage, before any further work is done to the hull, it is advisable to fix fuel tanks, knock-off switch, etc., and at the rear end, the propeller tail-shaft should be fitted.

The last stage is the decking in, and before the rounded top decking is fitted, some 1 mm. ply is fixed to the upper stringers so that the hull at this stage resembles a square fuselage. The balsa nose-piece is fixed, and then the rounded front deck. A $\frac{5}{16}$ in. ply former is used here, and is shown in the drawing at Section *A*.

The rear section of the decking is solid balsa 8 in. from the transom and is shaped and blended into the transome. Another former, similar to that used at *A*, will be necessary at *B* to support the 1 mm. ply that constitutes the rest of the rear deck.

All of the interior parts of the hull are treated with fuel-proof dope, using several coats, no paint being used. The outside is painted with cellulose and proofed with dope.

Transmission, etc.

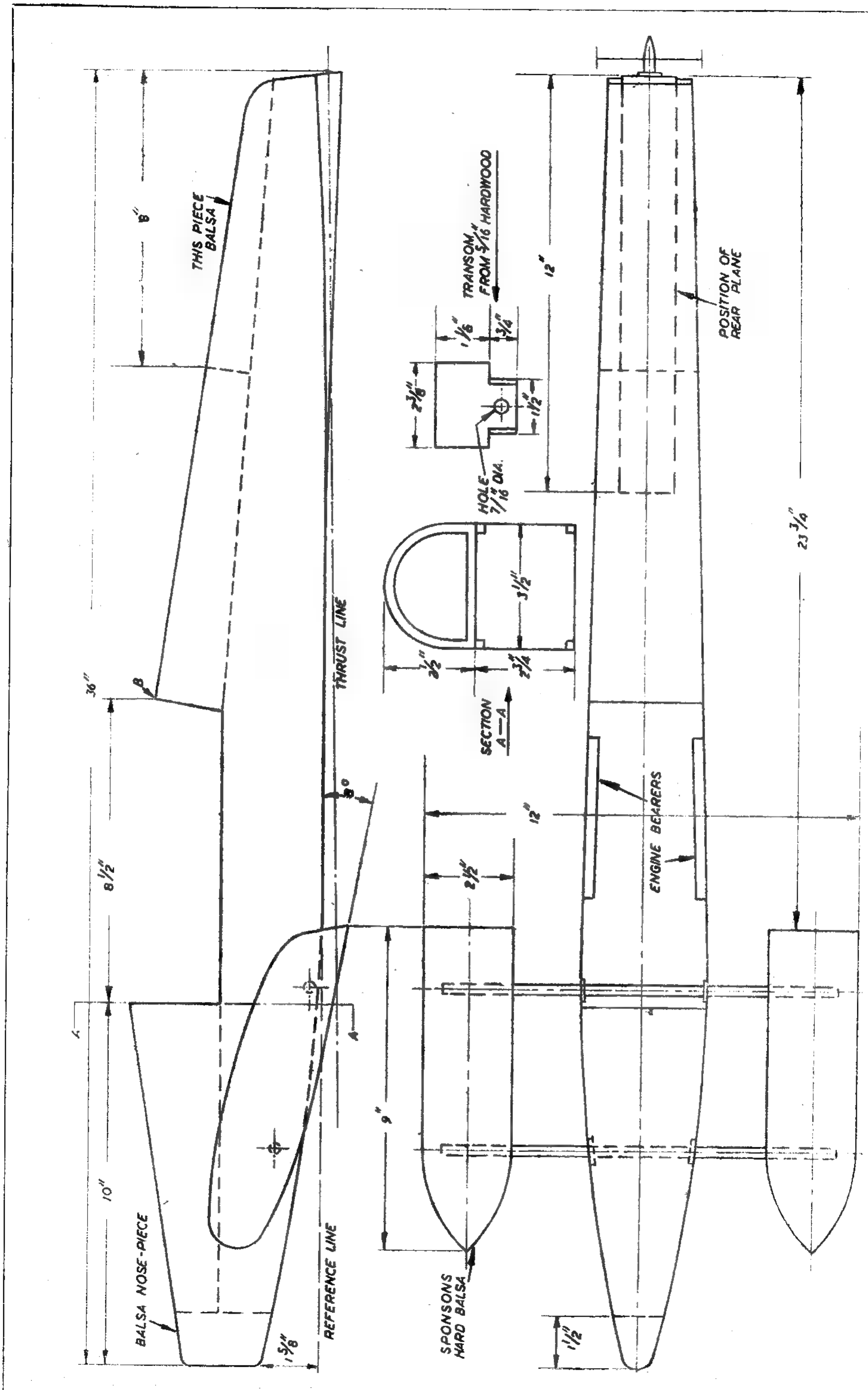
The propeller shaft is a length of $\frac{7}{16}$ in. diameter steel tube and is used unsupported except at the ends which are fitted with the usual "ball and pin" type universal joints.

The tailshaft bearing is quite simple and is turned from a piece of 1 in. diameter dural. This is reduced to $\frac{7}{16}$ in. except ⅜ in. from one end, which is left forming a flange 3/32 in. thick. A hole 9/32 in. diameter is drilled right through, and tufnol bushes are used at each end. One of these bushes takes the thrust also, and the amount of wear so far is negligible. The flange is used to secure the tailshaft to the transom, which is drilled with a $\frac{7}{16}$ in. diameter hole to receive this. Three screw holes are used for fixing and after assembly part of the flange is cut away to the level of planing strip.

The tethering of the boat has been the subject of some trial and error, and although several differing positions have been tried, there has not been much difference in the running of the boat. The photographs of the boat published so far will give some idea of the positions tried. The fittings are secured with bolts right through the hull, and dural plates used to spread the load.

(To be Continued)

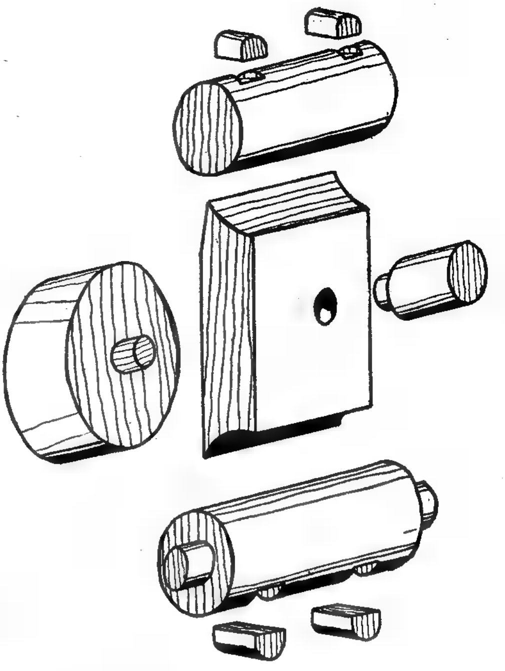
**Continued from page 716, "M.E.," November 29, 1951.*



Elevation, plan and details of the hull of "Sparky II"

*A Universal Dividing Head, PLUS

by A. R. Turpin



Exploded view, showing the construction of the pattern for the mandrel bearing casting

THE mandrel bearing casting (9) [redacted] [redacted] be dealt with. (See Fig. 15.) The construction of the pattern can be seen from the exploded drawing and needs [redacted] comment. Clean up the casting with [redacted] file, and grind the skin off the end faces of the mandrel, and back centre support bearing. Plug the core hole of the former, support the casting on [redacted] surface plate, and mark all the centres. Grip the large circular boss in the three-jaw and adjust so that the axis of both bearings revolve in the vertical plane. This [redacted] be achieved by lining up the centres vertically with [redacted] square [redacted] the lathe bed and horizontally with [redacted] rule pressed against the chuck face ; when this has been done, take [redacted] skim along the chucking-piece to turn it parallel. Now [redacted] the casting, gripping it by the chucking-piece, and face the circular boss, then centre drill, drill right through with [redacted] $\frac{1}{2}$ in. and open out to $\frac{7}{16}$ in. Bore the 1 in. diameter recess [redacted] nice fit on the locating boss of the carriage to [redacted] depth just over $\frac{1}{2}$-in. deep to give a working clearance, and then turn the outside diameter of the boss down to $2\frac{1}{8}$-in. diameter.

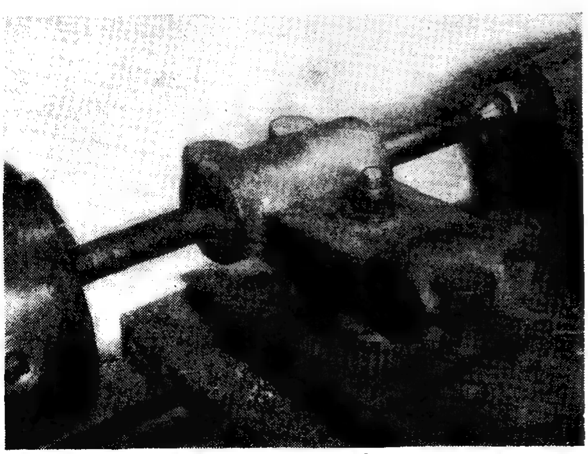
The periphery will eventually have to be divided into 5 deg. divisions for indexing the head, but this must be left until the dividing head proper is finished.

Remove the casting from the chuck, and [redacted] off the chucking-piece, leaving sufficient for facing so that it stands proud $\frac{1}{16}$ in. to act as a bolt-head seating.

The next job is boring the mandrel and back centre support bearings, and this is best done by bolting it to the cross-slide in the [redacted] shown in photo No. 18. A $\frac{3}{8}$-in. bolt is used and the casting packed up so that the centres of the bearings [redacted] [redacted] centre height. Considerable side pressure may have to be exerted when facing the ends of the bearings, and so, to prevent any danger of movement, a hole is drilled in a short length of $1\frac{1}{2}$-in. angle iron, and this is bolted to the cross-slide with the vertical portion abutting against the end face of the bearing [redacted] the opposite side.

This piece of angle is moved to the appropriate end as each one is faced. The casting having been carefully squared up, the cored hole is opened up with [redacted] boring bar to 1 in. dia.

It is difficult to work to exact dimensions unless the boring bar has [redacted] micrometer adjustment for the tool-bit, and if such [redacted] tool is not available it is simplest to bore the hole near the dimension required and then turn the mandrel to fit it. Before starting the boring operation, the gib strips should be tightened, and [redacted] reading taken of the cross-slide feedscrew index, allowing



Photograph No. 18. Boring the mandrel bearing

*Continued from page 792, " M.E.," December 13, 1951.

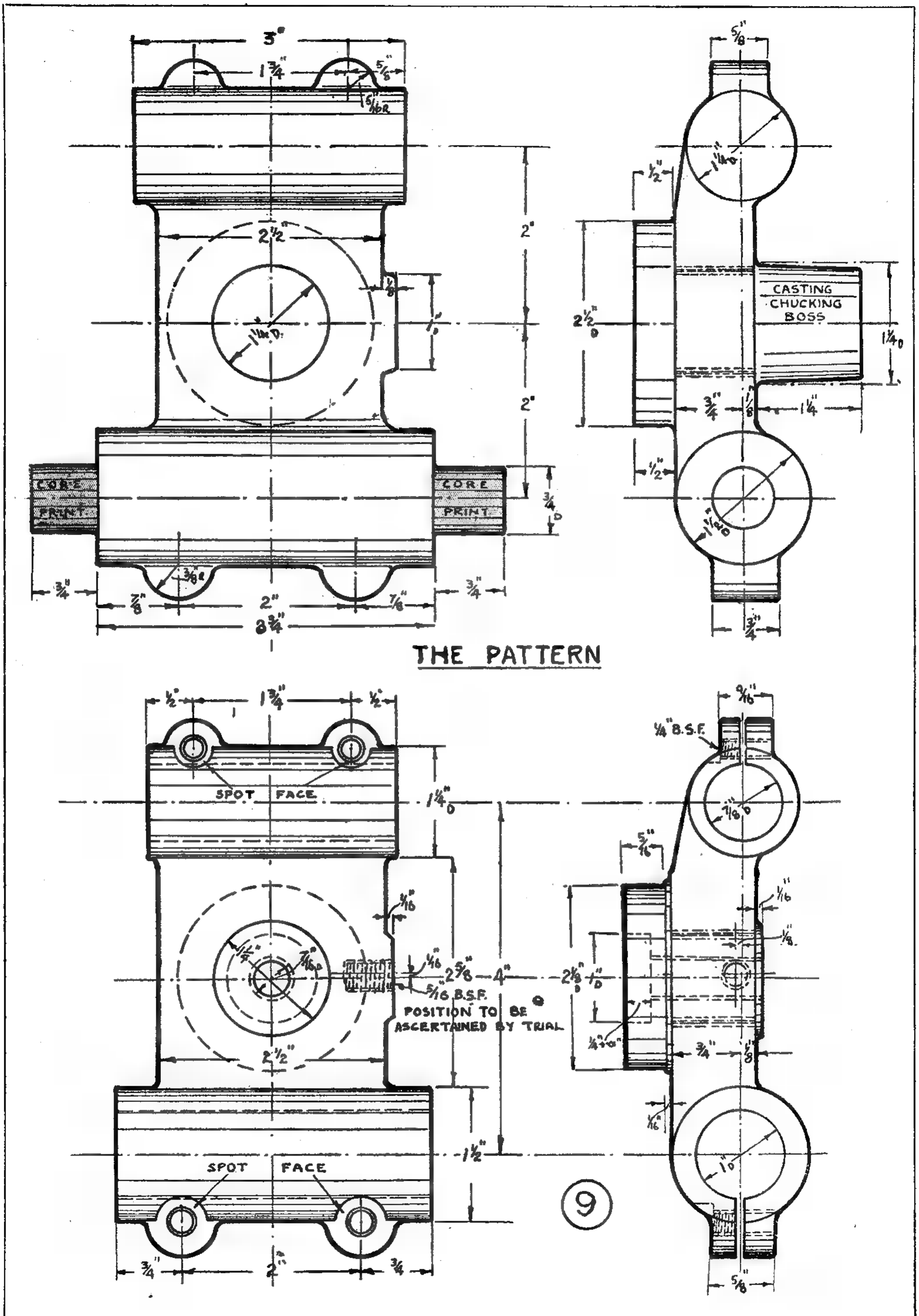
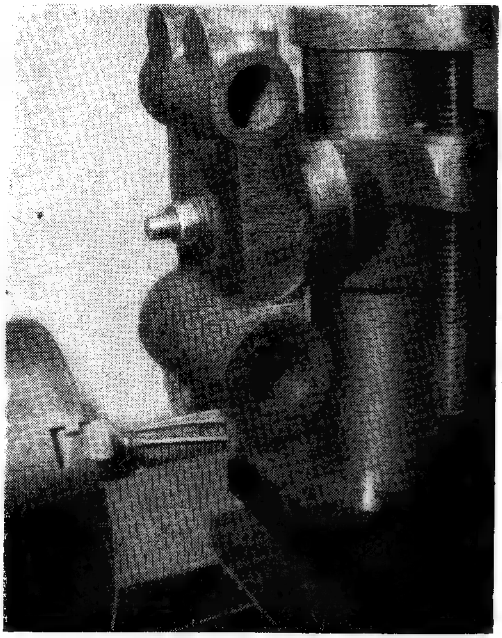


Fig. 15 MANDREL BEARING.



Photograph No. 19. Spot-facing the clamping-screw lugs of the mandrel bearing

for any backlash, and when the boring of the mandrel bearing has been finished, the gib strip is loosened and the cross-slide moved across exactly 40 turns of the feedscrew. The headstock drill chuck is now fitted with a centre drill, and the back centre support bearing drilled, then drilled right through $\frac{1}{4}$ in. and opened out by stages to, say, $\frac{3}{4}$ in., then finished to $\frac{7}{8}$ in. dia. with ■ boring bar, and the ends faced.

The casting can now be mounted on the dividing head carriage, and the pillar bolted to the cross-slide. Fit ■ suitable end-mill in the headstock, and by manipulation of the pillar and cross-slide feedscrews position the clamping-screw lugs, and spot face them as shown in photo No. 19. The lugs for the clamping-screws may now be drilled and tapped. This operation having been carried out, the casting is turned to the horizontal position, and after being carefully checked that it is parallel to the lathe bed, the small seating for the wormscrew bearing is faced with the side of the end-mill. (See photo No. 20.)

With the casting still in the horizontal position, a slitting saw is mounted between centres, and both bearings cut through (photo No. 21); this completes item (9).

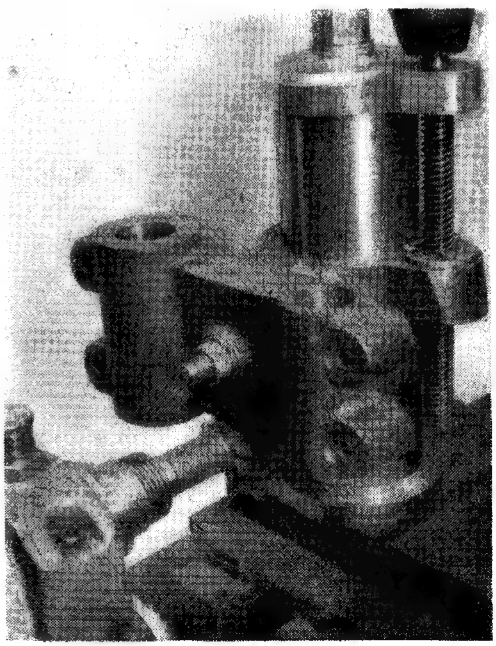
The Mandrel (10)

The mandrel is machined from ■ mild-steel bar $1\frac{1}{2}$-in. dia.; the bar should be $\frac{3}{4}$ in. longer than the finished dimension to allow for chucking. (See Fig. 16.) Chuck one end in the four-jaw and mount the other end in the fixed steady, and adjust to run true, then centre drill and face, reverse and repeat. Remove the fixed steady, bring up the back centre, and turn down the bar to just over $1\frac{3}{8}$-in. dia. for ■ length of $5\frac{1}{4}$ in.

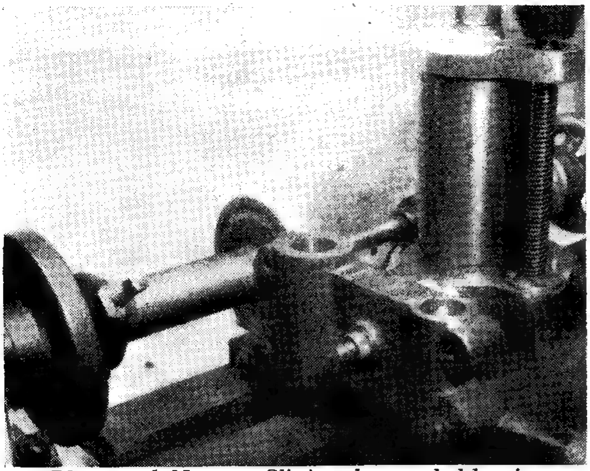
Mount fixed steady about half way down turned portion, and open up the centre to about $\frac{3}{8}$ in. dia. with square centre. Put drill chuck in tailstock, and using ■ B.S.3 centre drill, drill the end to ■ depth of $\frac{1}{2}$ in., continually clearing the drill so that it does not jam and break. A B.S.3 drill is specified because the body is exactly $\frac{1}{4}$-in. dia., and this will give a $\frac{1}{4}$ in.-drill a true start.

Now drill as deeply as you can with a $\frac{1}{4}$-in. twist drill, which should be ground and sharpened with great care and accuracy. Without moving the fixed steady, reverse the bar in the chuck and adjust to run dead true with the dial indicator. Repeat the performance with the centre drill and $\frac{1}{4}$-in. drill, and drill to meet the previous hole; they should do so quite accurately, but ■ small discrepancy in alignment is of no great consequence. Open up this drilled hole to nearly $\frac{7}{16}$-in. dia. to ■ depth of 1 in. and then bore this hole to the same depth exactly $\frac{1}{2}$ in. dia. This again will give ■ true start to ■ $\frac{1}{2}$-in. drill, which can now be mounted in the tailstock, and should be long enough to be pushed right through the mandrel. Open the end up again by boring to ■ depth of 1 in., 19/32 in. dia. and drill right through with this size drill, or ■ "D" type drill if you haven't a twist drill of this size; this type of drill being slower cutting, but giving a more accurate hole. Check the alignment of the hole and, provided that it is not more than 0.01 in. out of true, it will do.

The next operation is the most difficult to carry out accurately; that is boring ■ No. 2 Morse taper. Turning male tapers is child's



Photograph No. 20. Facing the seating for the worm screw bearing bracket



Photograph No. 21. Slitting the mandrel bearing

play compared with it, and you will most likely save yourself a lot of time and trouble if you buy, borrow, or make a taper reamer for the job; anyway, even if you have a reamer, the following procedure must be carried out. Set the top-slide to the correct angle, and this is best done by

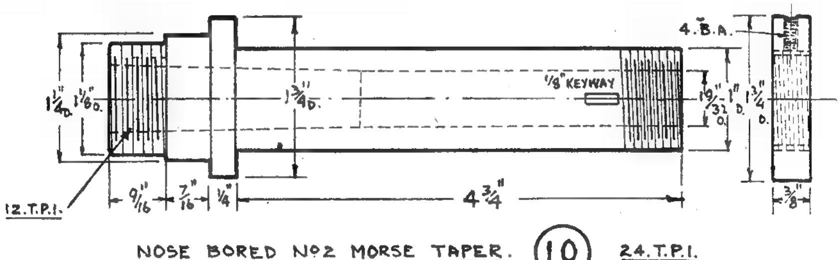


Fig. 16

mounting one of your lathe centres between a male and female centre, fixing the dial indicator in the toolpost and traversing the taper at dead-on centre height, and adjusting the top-slide angle

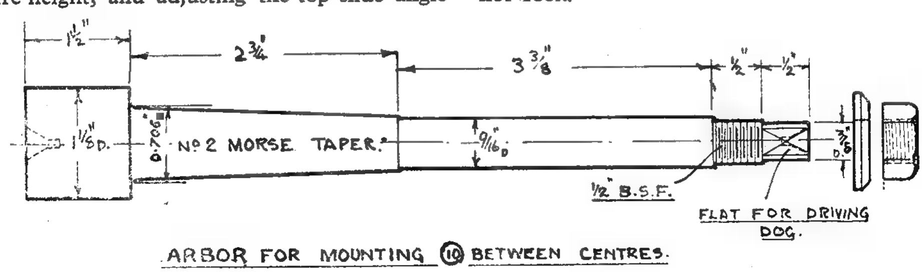


Fig. 17

until the pointer remains stationary for the full length of the traverse.

Replace the indicator with a sharp stout boring bar, and bore out the mandrel. When a taper portion about 1 in. long has been machined, test for fit with one of the lathe centres, and fitters' blue.

Owing to the spring in the boring bar you are almost certain to find that the taper is incorrect; you must then judge how much out the taper is and then mount the dial indicator on the lathe bed with the plunger touching the end of the boring bar, alter the angle by the amount you think is required. It should be noted that as the tool of the boring bar may be some 4 in. from the pivot point of the top-slide, the bar will have to be moved four or five times more than the taper is out of true. This adjustment having been made, take another skim and test again, and if necessary reduce or increase the previous adjustment. Continue this procedure until you get a perfect fit, or, if the worst happens, the taper is too deep, in which case you must scrap the whole thing, and start again. If you have a suitable reamer it is only necessary to bore the taper within a few thous. of accuracy, and then reamer the bore out. It should be remembered that when turning male tapers, if the tool is set above or below centre, the resultant taper will be concave, and it is still possible to get a fit; but in the case of a female taper the same error will cause a convex taper to be bored, and it will be quite impossible to get a fit that will not rock.

A Morse taper arbor is now turned to the dimensions shown in Fig. 17. The nose end may appear unnecessarily long and large, but it will be used for other purposes later.

(*To be continued*)

GET WEAVING!

An article on the construction of a working loom

by W. G. Field

GET weaving! An expression commonly used in its figurative sense in everyday language, but seldom acted upon literally.

What is weaving? How is it accomplished? Is it possible for the novice to make a hobby or a profitable business of this art? In the space available, this series of articles answers all these questions, and introduces the reader to the fascinating pastime of weaving.

The art of weaving is as old as civilisation, indeed, the ability to weave is in itself one of the marks of a civilised state. Until John Kay, in the middle of the eighteenth century, invented his power loom, all weaving for thousands of years preceding the event was essentially a manual operation, and the basic principle used in the times of the Pharoahs, for example, is still the same today, even in the most complicated of fast-running power looms.

Weaving is the process whereby lengths of thread running lengthwise are interlaced at right-angles to others running crosswise. The result of this interlacing is a woven fabric which may be patterned according to desire.

The best illustration of weaving is the simple, everyday, domestic task of sock-darning.

Constructional Details

Having studied the parts list and drawings, it would be advisable to cut all your wood to correspond with the sizes given. Each part should then have the item number pencilled on it, as this will assist in easy recognition later on.

To conform with the above, each part will be identified by its item number, and the modeller is recommended to follow the sequence of construction, as follows :—

Main Frame

Left Hand Side. Take items 1 and 2 and at a distance of 1 in. from the top, cut a recess, 2 in. wide and $\frac{3}{4}$ in. deep. Then drill a hole $1\frac{1}{16}$ in. diameter in each upright to take the front and rear rollers. (Note that this hole is not in the same position on each upright, so it is advisable to read the locating dimensions from the drawing.)

Item 3 has a groove $1\frac{1}{8}$ in. × $\frac{9}{16}$ in. deep cut along its length and a tail piece [illegible] in. long × $\frac{1}{4}$ in. deep at each end.

Make a tail-piece at each end of item 4, 2 in. long × $\frac{1}{2}$ in. deep, remembering to make the mortice to take the tenon on items 12.

These parts, when completed, can be glued into position and pinned to add greater strength.

Right Hand Side. Repeat the same procedure as described for the opposite hand, consulting the drawing to make sure that the groove for the reed and also the holes for the front and rear rollers are in their correct position.

Heddle Guide

The heddle guides, item 5, can then be slotted as shown on detailed drawing, and cross halved 2 in. × $\frac{1}{2}$ in. to fit items 3 and 8. Make certain that the grooves for the heddles are straight and of even depth to ensure easy movement. Do not [illegible] the heddle guides, item 5, until the reed is completed and ready for assembly on to main frame, as the guides for the heddle assist in locking the reed frame in its working position.

The same precaution applies to items 12, 10 and 11, but they can be shaped at this stage, to complete the main frame assembly. Shape the above items as follows : Make a tenon at each end of items 12, to fit the mortice in items 4 and 9. Then end half items 10 and 11, to fit flush with the top of the main uprights.

After the reed frame has been assembled and positioned in the main frame, glue the above items, testing the structure for squareness.

Reed Frame

A groove $\frac{1}{2}$ in. wide × $\frac{9}{16}$ in. deep is cut along item 23, which together with items 22 (side members) and 24 are jointed and glued, to form the slide for the reed.

The uprights, item 25, when slotted $\frac{1}{2}$ in. wide × $\frac{1}{4}$ in. deep are then jointed and glued into item 23, so that their outer edges are $\frac{1}{8}$ in. from the inner edge of items 22. This $\frac{1}{8}$ in. allows a clearance when operating the slide.

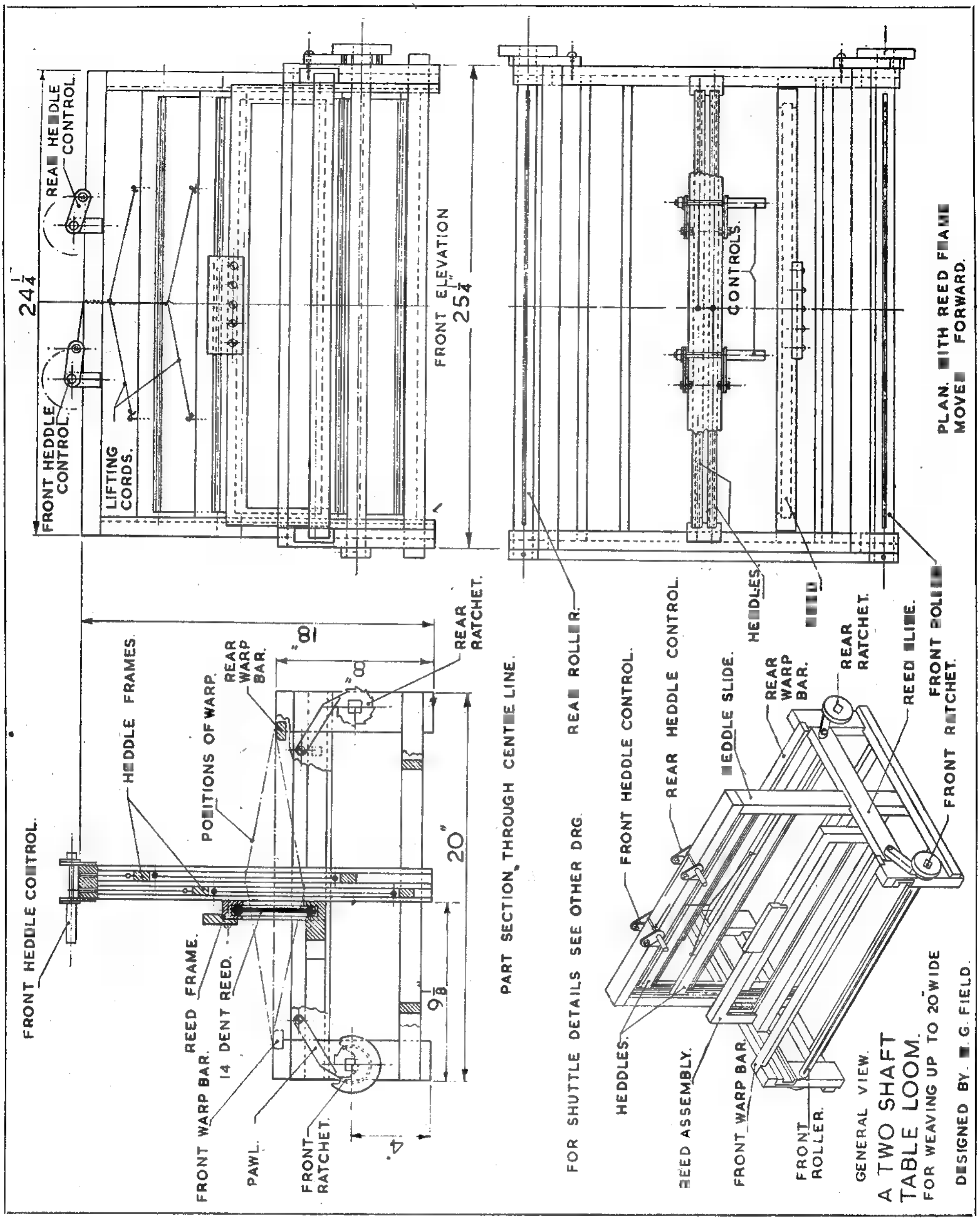
Cut a groove $\frac{1}{2}$ in. wide × $\frac{9}{16}$ in. deep in the top locking-bar, item 26, and then fit the reed handle, item 27, by securing it with five screws, as shown on detailed drawing. Care should be taken during this operation so that the ends of the screws do not foul the groove, when screwed into the top locking-bar.

The top locking-bar should be detachable to enable the metal reed to be dismantled for easy cleaning and so that a courser reed can be substituted.

The Metal Reed

This is constructed with 20 s.w.g. mild-steel strip 3/32 in. wide, by cutting off lengths $3\frac{1}{4}$ in. long (item 30) and smaller lengths of $\frac{1}{4}$ in. long, item 31.

Braze the above together at the top and base, inserting the smaller lengths between the long strips to form 14 spaces or dents per in. When this has been extended to $21\frac{1}{2}$ in. long, items 29 are fitted over the top and base of the reed and the whole assembly is then dropped into the slots on the reed frame and secured by the top locking-bar. Making the metal reed may prove too difficult to some readers, but they can be obtained to fit this loom from " Weavemaster Looms," G. R. Wood, 206, Kensington Church Street, London, W.8.



Heddles

Construct the heddles by jointing items 32 and 33 together, to form a frame that is perfectly square at all corners.

Drill two clearance holes in each upright member, so that the two dowels, item 34 ($\frac{1}{4}$ in. diameter), can be lightly held in position, thus enabling you to have easy access, when altering the number of desired healds, before weaving.

Two screw eyes, item 44, in the list of parts, are then screwed into the top member of each frame, referring to the drawing for position.

Wire Healds

The healds, item 35, again may present a problem to the inexperienced modeller and if so they can be obtained from "Weavemaster Looms," at the address quoted above.

However, here are the details of their construction and if a jig can be made, to enable you to speed up this operation, much monotony can be avoided.

Item No.	*Description*	*Material*	*No. Off*	*Size*
1	Front upright, left-hand	Wood	1	2 in. × 1 in. × [illegible] in. long
2	Rear upright, left-hand	,,	1	2 in. × 1 in. × [illegible] in. long
3	Reed guide, left-hand	,,	1	2 in. × 1 in. × 20 in. long
4	Base tie-bar, left-hand	,,	1	1 in. × 1 in. × 20 in. long
5	Heddle guide, left and right	,,	2	$1\frac{3}{4}$ in. × 1 in. × 17 in. long
6	Front upright, right-hand	,,	1	2 in. × 1 in. × [illegible] in. long
7	Rear upright, right-hand	,,	1	2 in. × 1 in. × [illegible] in. long
8	Reed guide, right-hand	,,	1	2 in. × 1 in. × 20 in. long
9	Base tie-bar, right-hand	,,	1	1 in. × 1 in. × 20 in. long
10	Rear warp-bar	,,	1	1 in. × $\frac{1}{2}$ in. × $25\frac{1}{4}$ in. long
11	Front warp-bar	,,	1	1 in. × $\frac{1}{2}$ in. × $25\frac{1}{4}$ in. long
12	Front and rear, base tie-bars	,,	2	1 in. × $\frac{1}{2}$ in. × $26\frac{1}{4}$ in. long
13	Front and rear rollers	,,	2	1 in. diameter × $27\frac{1}{2}$ in. long
14	Front and rear ratchet wheel	,,	2	2 in. diameter × $\frac{1}{2}$ in. thick
15	Countersunk wood-screw	Brass	4	No. 6 × $\frac{3}{4}$ in. long
16	Tension wheel	Wood	2	3 in. diameter × $\frac{1}{2}$ in. thick
17	Locking dowel	,,	2	$\frac{3}{16}$ in. × 1 in. long
18	Front and rear pawl	,,	2	$\frac{1}{2}$ in. × $\frac{7}{16}$ in. × $3\frac{5}{8}$ in.
19	Round-head wood-screw	Brass	2	No. 12 × $\frac{7}{8}$ in. long
20	Front and rear roller collar	Wood	2	$1\frac{1}{2}$ in. diameter × $\frac{1}{2}$ in. thick
21	Collar locking-dowel	,,	2	$\frac{3}{16}$ in. diameter × 2 in. long
22	Reed-frame slide-bar	,,	2	1 in. × $\frac{1}{2}$ in. × 11 in. long
23	Base locking-bar	,,	1	2 in. × 1 in. × 24 in. long
24	Reed-frame, rear tie-bar	,,	1	$\frac{1}{2}$ in. × $\frac{1}{2}$ in. × 24 in. long
25	Reed-frame uprights	,,	2	1 in. × 1 in. × $4\frac{1}{2}$ in. long
26	Top locking-bar	,,	[illegible]	1 in. × 1 in. × 23 in. long
27	Reed-frame handle-grip	,,	1	2 in. × 1 in. × 5 in. long
28	Round-head wood-screw	Brass	5	No. 6 × $\frac{7}{8}$ in. long
29	Reed-bar, base and top	Wood	2	$\frac{1}{2}$ in. × $\frac{9}{16}$ in. × $21\frac{1}{2}$ in.
30	Reeds. $3\frac{3}{4}$ in. long	Steel	15/in.	3/32 in. × 20 s.w.g.
31	Top and base dent-spacers	,,	14/in.	3/32 in. × 20 s.w.g. × $\frac{1}{4}$ in.
32	Heddle sides	Wood	4	$\frac{1}{2}$ in. × $\frac{1}{2}$ in. × $11\frac{1}{4}$ in. long
33	Heddle top and base	,,	4	$\frac{1}{2}$ in. × $\frac{1}{2}$ in. × $22\frac{3}{4}$ in. long
34	Heald supports	,,	4	$\frac{1}{4}$ in. diameter × $22\frac{1}{2}$ in. long
35	Healds (make up with two lengths)	Steel	Min. 280	27 s.w.g. × $10\frac{1}{2}$ in. long
36	Control-bar	Wood	1	$1\frac{3}{4}$ in. × 1 in. × $24\frac{1}{2}$ in. long
37	Hinge-plates	,,	4	$\frac{3}{4}$ in. × $\frac{1}{4}$ in. × $1\frac{7}{8}$ in. long
38	Links	,,	4	$\frac{3}{4}$ in. × $\frac{1}{4}$ in. × $2\frac{3}{8}$ in. long
39	Handle	,,	2	$\frac{1}{2}$ in. diameter × $4\frac{7}{8}$ in. long
40	Hex.hd. screw	Steel	4	$\frac{1}{4}$ in. B.S.F. × $\frac{3}{4}$ in. long
41	Hex. nut	,,	4	$\frac{1}{4}$ in. B.S.F.
42	Round-head wood-screw	Brass	8	No. 4 × $\frac{3}{4}$ in. long
43	Shuttle	Wood	1	$1\frac{1}{2}$ in. × $\frac{3}{8}$ in. × 26 in. long
44	Screw-eye	Steel	4	$\frac{1}{2}$ in. long

List of parts

Take two strands of 27 s.w.g. steel wire approximately $10\frac{1}{2}$ in. long, and at each end form a loop around a $\frac{5}{16}$ in. dowel, twisting a sufficient free length to make a twisted portion of $\frac{3}{8}$ in. The two strands are twisted together in the above and stage, to form the eyelet, [illegible] $\frac{1}{8}$ in. diameter dowel is inserted in between the two strands exactly half way between the end loops, that is, $4\frac{5}{8}$ in. from each end. Twist [illegible] $\frac{3}{16}$ in. portion on each side of the dowel and then remove it.

As a double check, when you have made one heald, slide it on to the heddle dowels to see if it doesn't flap about. If it is [illegible] good fit, use this one [illegible] master copy and build the others, using this as [illegible] guide. Of course, if you can make [illegible] jig as already stated, much work will be eliminated, as a minimum of 280 healds are required.

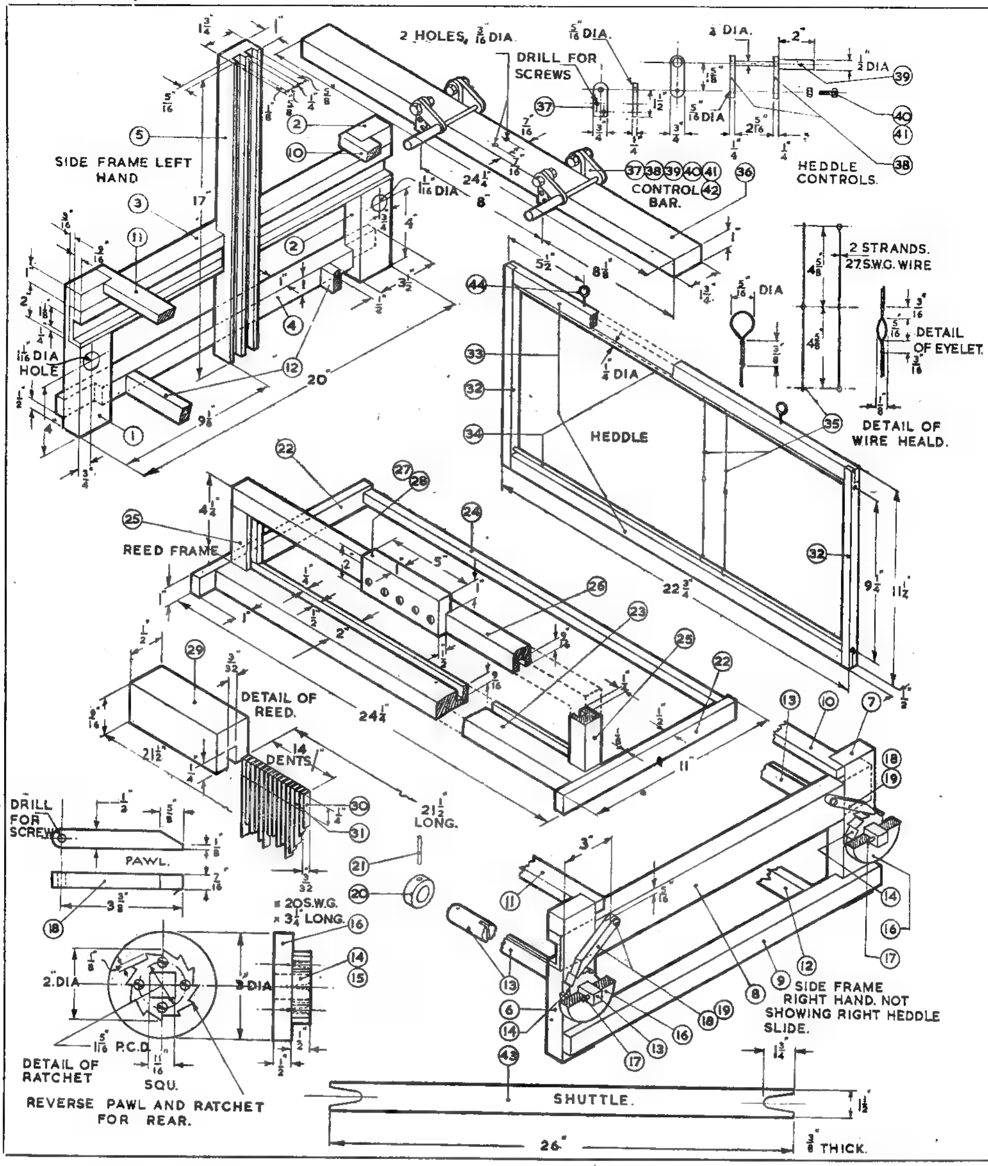
This number is derived from the necessity for needing one heald for each reed dent. Or, when using [illegible] 14-dent reed, the following calculation will give you the number of healds required.

Where *W* is the width of the material to be required, up to 20 in. width, and *D* the gauge of the dent (in this case 14 dents) then *W* multiplied by *D* = number of healds. Example: 20 in. × 14 dent/in. = 280 healds. Halve this number and mount one half on to the front heddle and the remainder on to the rear heddle. It may help the readers, to remind them, that when twisting the two strands of wire to form the loops and eyelet, to keep the twisted portions local about the loops. Then to make the healds more efficient, it is advisable to have them plated to stop rusting.

Controls

Two $\frac{3}{16}$ in. diameter holes are to be drilled in the control bar, item 36, to position shown on drawing. Then the four hinge bars, item 37, are screwed to it.

For lifting the heddles, items 38, which are the



levers, and item 39, the handle, are made and held in position by $\frac{1}{4}$ in. B.S.F. bolts and nuts. Tighten these sufficiently, to allow easy operation of the handles.

Shuttle

No loom would be complete without this, and it is essential that you make a shuttle for each colour you intend to work with.

Positioning the Heddles

It will be seen, that on the general arrangement drawing, the warp, shown by chain-dotted lines, occupies two positions about a centre-line, drawn from the end warp-bars. Joined on the warp-bars, and opening out to 3 in. at the heddle. The gap thus formed is called the shead, and it is created by lifting one of the heddle frames.

So each heddle must be connected to the controls as follows :

To one of the screw-eyes on the front heddle, tie a length of strong, but fine string. Leave sufficient slack in the string before tying the remaining end to the other screw eye, to form a triangle, with the top of the heddle as the base, and the centre of the string forming an apex of $1\frac{1}{2}$ in. from the base.

Repeat the above with the rear heddle.

Position the control-handles so that they both point to the right.

Drop the front heddle, until the eyelets [redacted] the healds are $1\frac{1}{2}$ in. below the centre-line quoted earlier in the text.

Tie [redacted] length of string to the centre of the piece that has just been described, and thread it through the front hole in the centre of the control bar. Tie the loose end to the *left* control handle.

With the rear heddle lifted to $1\frac{1}{2}$ in. above the centre-line, repeat this procedure and tie to right control handle. When both heddles are thus supported, reverse the position of the control handles, and in doing so, the front heddle should now be $1\frac{1}{2}$ in. above the centre-line, and the rear heddle in the position previously held by the front heddle.

During the construction of the loom, all corners must be tested to ensure that they are square, and it is advisable to rub [redacted] little graphite on to the sliding parts. This will cut down friction and make the operation of the loom easier.

No glue must be allowed to enter the groove forming the slides. If it does, it must be completely removed, or the sliding member will continue to foul and make your weaving a disagreeable business.

It is well to note that the loom described [redacted] be made into [redacted] four-heddle loom quite easily, thus enabling you to weave more intricate patterns than before.

However, before you attempt this I suggest you master completely the art of weaving with [redacted] two-heddle loom. The loom will only weave to a width of 20 in. and if [redacted] greater width is required, the necessary dimensions of the reed, heddle frames, and shuttle must be considered.

The use of hard wood in all cases where wood is required, will make the finished loom stronger and cut down the friction on sliding parts.

All the dimensions given in the list are finished sizes and sufficient for one item only. In the cases where two or more parts under the [redacted] item number are required, increase the length of the material as desired.

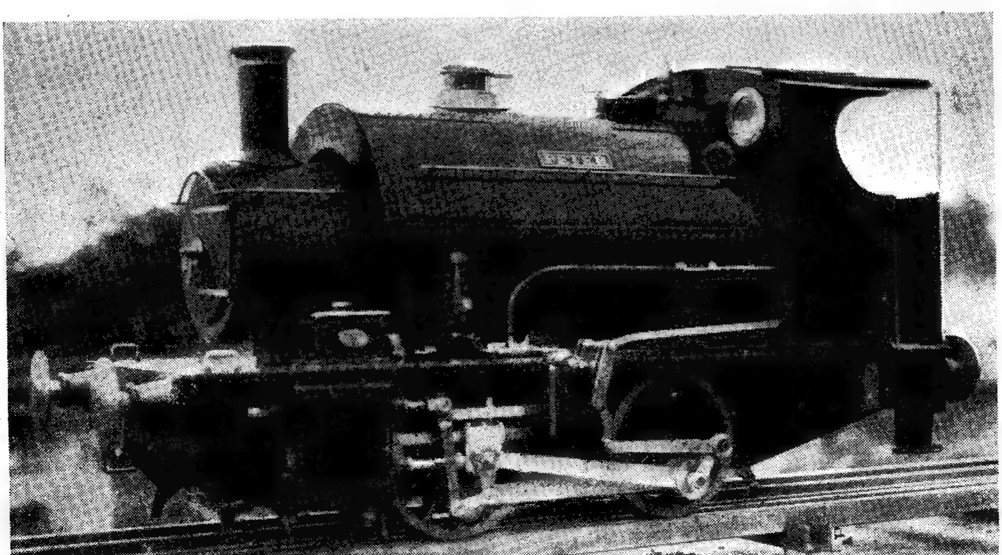
(*To be continued*)

A $7\frac{1}{4}$-in. Gauge Saddle-Tank Locomotive

THE photograph reproduced herewith shows [redacted] neat 0-4-0 saddle-tank engine for $7\frac{1}{4}$ in. gauge built by T. Mallaby & Co., 66, Meadow Lane, Leeds, 1. As will be seen, the proportions are excellent and the general effect very pleasing. We think, however, that if *we* were to build this engine, we would change over the positions of the safety-valve and tank filler, as being more in accordance with generally-accepted practice. We know that there are full-size locomotives which have the safety-valves positioned well forward on the boiler barrel, the idea being that there is less likelihood of water being thrown out with the steam when the valves are operating. There may be something in this idea, but we think it has yet to be proved; we prefer a safety-valve to be placed at or near the point of greatest stress!

Messrs. Mallaby have sent us a copy of the blueprint general arrangement drawing for this engine; we understand that detail drawings and castings are also available.

That the engine is a powerful unit is evident from [redacted] photograph we have seen of it hauling [redacted] load of three adults and fifteen children.



Novices' Corner

Fly-cutting

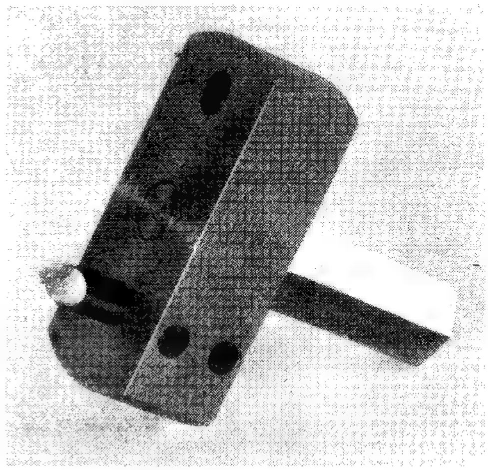


Fig. 1. An easily made fly-cutter with two tool positions

FLY-CUTTING is usually carried out with [redacted] single-point tool mounted in [redacted] holder for gripping in the lathe mandrel chuck, or the tool may be carried in [redacted] arbor running between the lathe centres, or, again, [redacted] cutter frame attached to the lathe saddle may be used for this purpose.

Although the fly-cutting tool is not primarily intended for removing large amounts of metal, it has, nevertheless, the advantages that it is easily and cheaply made of high-speed steel to any required shape, and when blunted it can be readily resharpened by straightforward grinding and oilstoning.

Milling cutters, on the other hand, are relatively costly and need special grinding equipment for resharpening. Again, by using [redacted] fly-cutter, sharpened on an oilstone, [redacted] very fine, chatter-free finish can without difficulty be given to the work, whereas in light lathes [redacted] good finish is not always obtained with the ordinary milling cutter, especially when the teeth have become slightly blunted.

Making a Fly-Cutter

A simple form of fly-cutter head for mounting in the self-centring chuck is illustrated in Fig. 1.

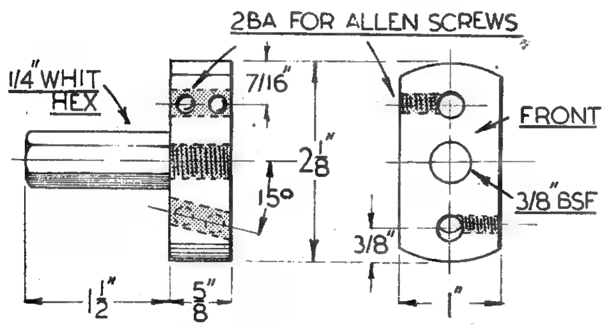


Fig. 2. Showing the details of the fly-cutter parts

The self-centring chuck can be used for this purpose, [redacted] with [redacted] single-point tool there is, of course, no need for the holder to be truly centred; but if [redacted] milling cutter does not run truly, cutting will be intermittent and the bulk of the work will fall [redacted] [redacted] few teeth only; in fact, an eccentrically mounted milling cutter will behave rather like a fly-cutter, but has [redacted] of its advantages.

The head illustrated was made from [redacted] short length of $\frac{5}{8}$ in. $\times$ 1 in. mild-steel and is intended to carry cutter-bits of $\frac{1}{4}$ in. diameter high-speed steel. Two tool housings [redacted] provided; the axial mounting of the tool will serve for all ordinary facing work, but when cutting against an overhanging shoulder the tool is mounted obliquely in the second tool housing.

This obliquely-placed hole is best drilled at the outset and before the bar is cut to the finished length. If the work is set at an angle of 15 deg. for drilling this hole, the drill will be deflected and the drilling will be out of line even if the drill does not break in the process. To give guidance to the drill point at starting, [redacted] hole of $\frac{1}{4}$ in. diameter at its mouth is first drilled at the back of the part with [redacted] centre drill and with the work held horizontally in the machine vice. Next, [redacted] drilling guide, made of mild-steel $\frac{1}{8}$ in. in thickness, is clamped to the work, as shown in the illustration. The guide is positioned with its $\frac{1}{4}$ in. diameter guide hole exactly over the centre hole already drilled in the work. When the work has been set in the vice to an angle of 15 deg., a letter D drill is put right through, and the drilled hole is then finished to size with [redacted] $\frac{1}{4}$ in. diameter reamer. Work the reamer in carefully, turning it always in a forward direction and at the same time applying plenty of cutting oil. The second or axial tool housing can now be drilled and reamed, and the central hole for mounting the shank is drilled with a letter P or [redacted] 21/64 in. diameter drill and then tapped $\frac{3}{8}$ in. B.S.F.

The shank fitted to the cutter head is shown made from [redacted] piece of $\frac{1}{4}$ in. Whitworth nut-size hexagon bar, as this gives the finished tool a secure mounting in the three-jaw chuck. If preferred, [redacted] round shank [redacted] be used, and [redacted] tommy hole is drilled across for screwing the head into place; in addition, the backward projecting end of the cutter-bit then abuts against one of the chuck jaws and so prevents slipping. When

hexagonal material is used, the shoulder formed on the shank should be machined so that the head, when screwed firmly home, lies with the tool housings in line with the flats of the hexagon; this allows the tool shanks to pass between the chuck jaws when the fly-cutter is in use. The curved surfaces at the two ends of the head are machined by gripping the shank in the chuck and

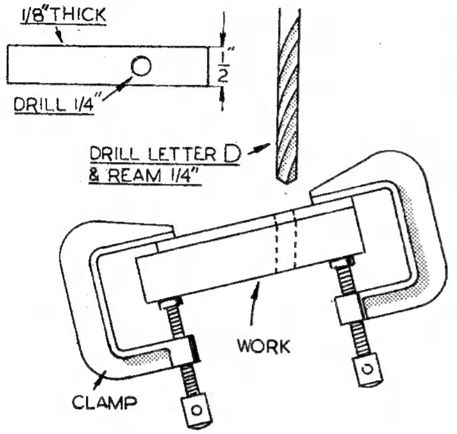


Fig. 3. *Showing the method of using the drill guide to form the oblique tool housing*

then using a knife tool to take light cuts until an even finish is obtained. To complete the work, the Allen grub-screws for securing the tools are put in and, after the front and back faces of the head have been finish turned, the side surfaces of the head and the shank are filed to a good finish. It should be noted that the clamp-screws are

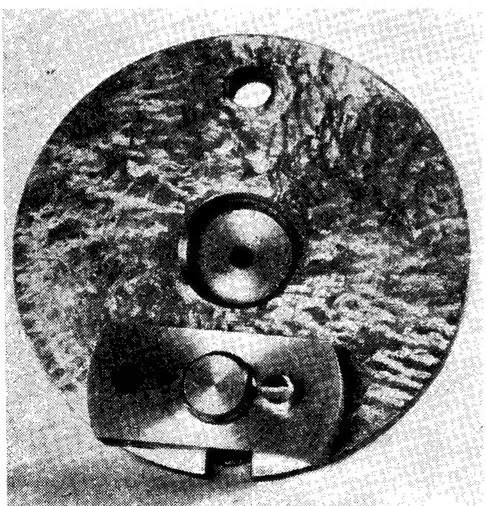


Fig. 4. *The fly-cutter head attached to the lathe driver plate*

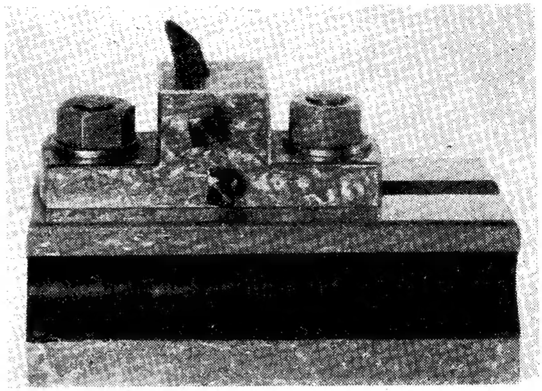


Fig. 5. *A fly-cutting attachment for large work*

fitted so that the cutting pressure forces the tool against its housing and not against the screws themselves. The tool just described, when mounted in the self-centring chuck, will cut on a fixed radius of about $\frac{5}{8}$ in., but to machine a larger area the head is unscrewed from the shank and then attached either to the lathe driver-plate or to the faceplate with a single clamp-bolt, as is shown in Fig. 4.

Other Forms of Fly-Cutters

Another way of mounting a tool to machine on an extended radius is to use a device like that illustrated in Fig. 5. Here, a cast base with a

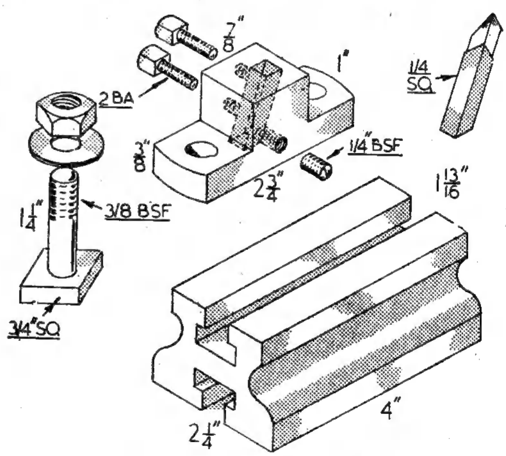


Fig. 6. *Constructional details of the large fly-cutter*

T-slot at back and front is bolted to the lathe faceplate, and the toolholder can then be set in the front T-slot to any radius required, provided that there is space enough in the lathe bed gap. A square tool is fitted and, as it is a difficult matter to file a square hole with its sides flat, a grub-screw is inserted at the far end of the housing so that the tool can obtain an even bearing and will not tend to rock when secured by the clamping-screws.

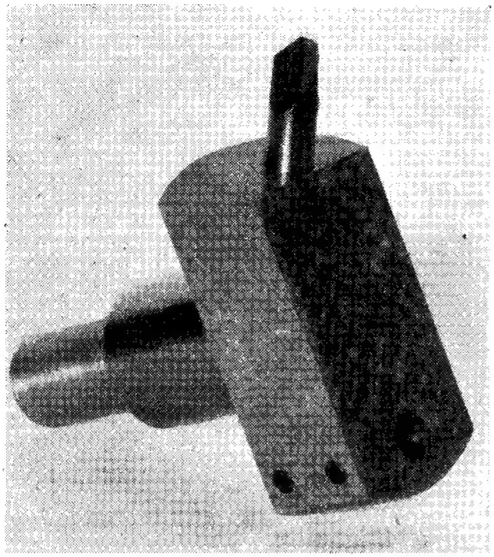


Fig. 7. A fly-cutter for use in a large lathe

The fly-cutter illustrated in Fig. 7 was made for use in a large lathe and is capable of carrying out quite heavy machining.

The tool-bits fitted are $\frac{3}{8}$ in. in diameter and, as before, both axial and oblique housings are provided. As will be seen, the cutter when set obliquely lies at a more obtuse angle than in the previous tools; this enables the tool housing to be more easily drilled, as a flat drilling surface can be filed without materially reducing the length of the tool housing. As this tool was used for taking heavy cuts, a flat was ground on the under side of the tool to give a bearing for the clamp-screws and prevent the cutter's turning. As previously mentioned, it is advisable to fit the clamp-screws so that they hold the tool-bit against a solid face, but in this instance the clamping-screws have been put in on the reverse side. This means that the clamping area to resist the cutting thrust is limited to the distance between the two screws, instead of being for the full length of the housing; moreover, the pressure then falls on the screw threads and not on the solid metal of the head.

Cutter-bits

The tools carried in the fly-cutter head are formed on the same principles as are used for grinding lathe tools; that is to say, adequate clearances must be given at the cutting edges, and the amount of rake will depend on the material being machined. To obtain a really good finish when fly-cutting a flat surface, the rounded tip of the tool should be honed on an oilstone until the cutting edge is made perfectly smooth and regular.

The speed at which these cutters should be run is, again, in accordance with ordinary turning practice, and it matters little in adjusting the cutting speed that, here, the work is stationary and the tool is revolving. For example, if, when machining mild-steel, a high-speed steel cutter revolves on a radius of 1 in., the tool will travel approximately $\frac{1}{2}$ ft. at each revolution, and a cutting speed of 100 ft. a minute will, therefore, be obtained with the lathe set to run at 200 revs a minute.

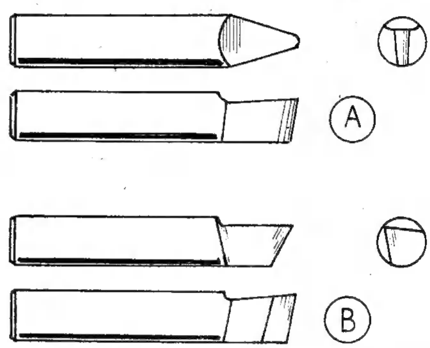
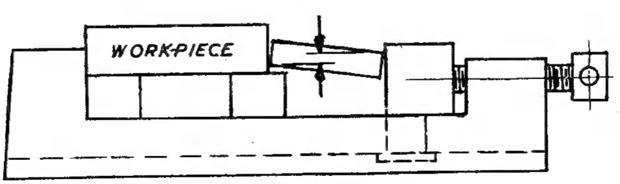


Fig. 8. Fly-cutter tools. A, a front tool; B, a tool for undercutting a shoulder

VICE WORK

HERE is a tip to those who find difficulty in maintaining the work-piece close to the parallels when placed in a vice.

A square-edged strip is interposed between the piece and the loose jaw, as shown. When the jaw is tightened the canting action forces the piece downwards.



The secret is to have the contact edge of the strip which touches the work lower than that which is against the loose jaw.—H. T. TROTMAN.

PRACTICAL LETTERS

Protection of Bright Steel Parts from Rust

DEAR SIR,—I have been reading with some interest the recent letters re. protection of tools, etc., from rust, as I have also encountered this trouble in my own workshop. However, my attention has recently been drawn to a different form of protection which I think will prove of great interest and benefit to all interested in the subject.

This takes the form of specially treated paper, which when placed near the article to be protected, gives off a vapour which prevents the moisture present forming rust; and if rust is previously present, its spread is prohibited. The paper is known as V.P.I. paper (Vapour Phase Inhibitor) and is developed by the Shell Organisation and supplied by the following firms:

Leonard Stace Ltd., York Place, Swindon Road, Cheltenham, also R. A. Brand & Co. Ltd., Field House, Breams Buildings, Chancery Lane, London, E.C.4.; from whom further details may be obtained.

Various grades of the papers give protection up to 4 years and it is generally reckoned that 1 sq. ft. of the V.P.I. paper will protect 1 cu. ft. of parts, the paper not necessarily being in contact with the article, provided it is near.

My greatest difficulty was the protection of the smaller tools, such as micrometers, scales, squares, etc., which are normally kept in drawers or cupboards, and for that problem I think that these V.P.I. papers provide the answer, since if the drawer has only one side lined with the paper, the contents would be preserved for some time. Of course, there are many more applications which become obvious when the advantages are considered.

Yours faithfully,

Rugby. A. M. SABINE.

Historic I.C. Engines

DEAR SIR,—The cover of the Nov. 1st issue depicting one of the most outstanding examples of technical skill and historical accuracy at the hands of two expert craftsmen, strikes a significant note with the past.

From first-hand information, the writer learned of the protracted search among patents records before even the drawings were prepared.

To the model engineer-historian there awaits another, and even more difficult, task in the scale model of the Hornsby-Akroyd oil engine, the world's first fuel-injection plus semi-compression-ignition motor.

It fell to the lot of the writer, as an apprentice, to be in charge of one of these engines, used to drive the private house installation of clients at Walton-on-Thames.

Briefly, the engine generally was of the then popular horizontal type, common to both gas and oil fuel. At the rear of the cylinder was a cast-iron "hot bulb," to which was fixed an injection nozzle, supplied from a pump driven from the camshaft, through a pipe led to the supply tank in the engine base. The governor was of the centrifugal type in which a tappet depressed a valve, short circuiting the injection nozzle, the fuel flowing through a small funnel piped to the main supply tank.

Under the hot bulb was a small furnace which, when charged with paraffin, lighted, and, aided by a hand-turned fan, heated the bulb sufficiently to attain ignition point primarily. This done, the pump was given two strokes by hand, and the flywheel two smart turns, and the engine was away for the day's run.

A few minutes sufficed to raise the bulb to red heat, after which, aided by compression, ignition proceeded without a hitch.

This invention not only preceded the diesel type, but was an oil engine from the very first, as Dr. Diesel's first patent specification described and illustrated a crude idea in which *solid coal dust* was the fuel. As it stands in the specification, the whole thing is manifestly impracticable and unworkable.

It is noteworthy that actual priority in fuel injection is due to Priestman, of Hull, about 1886, whose finely-divided jet was described as the "pneumatic poker." In this engine, ignition was by h.t. induction, spark coil, energised by a bichromate primary battery.

So come on, ye historian-engineers and add fresh laurels to your triumphs.

Yours faithfully,

Kingsgate. WARING S. SHOLL, A.M.I.E.E.

Growing Larger

DEAR SIR,—I am interested in your note in "Smoke Rings" in November 15th issue re increasing size of models, particularly locomotives.

Well, did not most of us older ones want to be engine drivers in our young days? (and still do'!). Few of us have the opportunity of driving full-size locomotives, but surely the larger the scale, the more realistic the model becomes.

Our late Editor discusses the size of models in "Smoke Rings" in October 22nd, 1936, issue: he states that a model may be as large as, or larger than, the prototype.

For many reasons most of us are limited to something fairly small, and I don't expect to see a full-size model of an old broad gauge engine running in someone's back garden, but let us have locomotives as large as workshop and other facilities will allow.

To me, all realism is spoilt by a raised track (I have been nearly as scared on a $2\frac{1}{2}$ in. raised track as when doing my first solo flight). A small 5 in. gauge locomotive such as mine needs very little, if as much, work as a large $3\frac{1}{2}$ in. gauge engine, and this and larger gauge models run on ground level—one can have points and sidings, means for engine to run round train at end of journey, tunnels, signals of scale height, *and* not so far to fall!

Yours faithfully,

Derby. A. F. LEE.

Reply to a Critic

DEAR SIR,—In your issue of THE MODEL ENGINEER for November 15th, Mr. W. J. Hughes implies that the connecting-rods of my "Juliet" are made of aluminium, which is not correct; they are made of mild-steel as specified by the designer and followed up by him in his many articles on this subject in your valuable journal.

As the engine is again in a further competition in the north, I feel that this mistake should be pointed out, as this misleading statement could influence its chances of winning a prize. For the information of Mr. Hughes I would like to add that what he refers to is a coat of aluminium that retains its colour and prevents rust.

Yours faithfully,

York. DAVID DOBSON.

How to Make It

DEAR SIR,—I entirely agree with the general remarks contained in the letter from J. D. Bisdee of your issue of November 8th on more articles of a how-to-make-it nature. Personally, I only get home to my workshop one day a week, and sometimes I feel the need for something to tackle and finish during that day, or two such days. An excellent example of last year, I believe, was the fishing reel, which could be made in one day or at the most, two.

I am personally engaged on *Juliet*, but as can be realised—at one day a week it will take some considerable time to finish.

I feel that this suggestion will produce a host of supporters from your ever increasing circulation.

Thanks, anyway, for the pleasure of receiving and reading your MODEL ENGINEER.

Yours faithfully,

Scampton. Flt.-Lt. J. F. THOMAS.

Copper Plating on Aluminium

DEAR SIR,—With further reference to the "Practical Letters" on this subject, the Northern Aluminium Co. give the following directions—you will note that the process is somewhat complicated, and finally calls for a *cyanide* plating bath. I think that your correspondent should be warned, if he has not chemical laboratory experience, of the dangers of cyanide. The process is not safe to recommend to a correspondent who may hope to work the process on the kitchen table! For what it is worth, here it is (my own remarks are given in italics):—

1. Thoroughly degrease—in trichlorethylene or similar solvent.

2. Acid pickle, which removes a small amount of metal and embedded surface impurities.

Chromic acid 35 gm.
Sulphuric acid 176 gm.
} per litre of solution.

Immerse for 1 to 5 min. in bath at 150 deg. F.

3. Rinse in plenty of hot (*?boiling*) water.

4. Nitric acid etch. Commercial concentrated nitric acid, 10 to 15 sec. (*do it out of doors!*).

5. Rinse in plenty of hot (*?boiling*) water.

6. Zinc immersion, giving thin adherent deposit of zinc.

Zinc oxide 100 gm.
Caustic soda 525 gm.
} per litre solution

Immerse 2 to 5 min.

7. Very thorough hot water rinse in two lots of water.

8. Copper-plate "strike."

Copper cyanide 31.3 gm.
Sodium cyanide (total) 50.8 gm.
Sodium carbonate 30 gm.
Rochelle Salt 60 gm.
} per litre solution (finally contains 3.6 gm. free NaCN per litre.)

Subsequent to the "strike," when a thin coating of copper is obtained, a further plating with nickel or other metal may be given.

If aluminium contains magnesium of 3 per cent. or more, a deposit of brass "strike" is advised before copper (*No formula suggested*).

I think, if further information is needed, one should write to the Northern Aluminium Co. Ltd., Banbury, Oxon.

Mr. P. A. Raine, of Johnson & Phillips, in a letter in *Wireless World*, October, 1951, mentions the use of a solder of 90 per cent. tin, 10 per cent. zinc used commercially on aluminium-sheathed cables. It would be a much simpler process than plating.

Yours faithfully,

Cambridge. C. R. COSENS.

"That Wonderful Year . . ."

DEAR SIR,—*Re* Mr. Yalden's letter in THE MODEL ENGINEER of November 29th, concerning a model of a locomotive by Watkin & Hill. I have approached a friend of mine, an official with Messrs. Elliots, on the subject and am glad to say that I have had the opportunity of examining the model at the works.

It differs slightly from the diagram published in the October 18th issue.

Apparently, the origin of the model is unknown.

These old models are certainly interesting and this one is in a good state of preservation.

There are no flanges on the wheels; it also has a tender.

Yours faithfully,

Lewisham, S.E.13. J. R. LONGHURST.

Acknowledgments and a Request

DEAR SIR,—As a reader of THE MODEL ENGINEER since the "grey-green tuppeny" days, may I say how much I have learnt during the years from its columns. Although never a "model maker," my own profession has brought me in close contact with fine engineering and instrument work, and many a time a tip gleaned from your journal has saved the day. In this connection many thanks to "L.B.S.C.", "Duplex," Mr. Eley and many others too numerous to mention, whom I have regarded as friends talking to me through the pages.

I am thinking of making up the "Plus" milling and dividing head by Mr. Turpin and intend to adapt this to a "Hobson" lathe I have on order. Has any reader had one of these lathes delivered? If so, may I request, through your columns, the opinion or experiences with this machine. I will gladly pay any postage, etc., incurred should any fellow reader write to me.

25, Ryefield Road, Yours faithfully,
Upper Norwood, S.E.19. A. F. LEGG.